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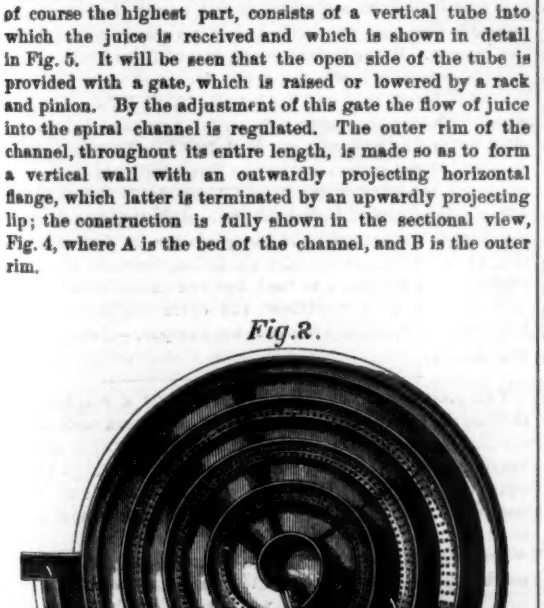
IMPROVED SUGAR EVAPORATING APPARATUS.

The sugar evaporating apparatus illustrated in our engravings was patented through the Scientific American Patent Agency, July 2, 1872, for José Guardiola, of Chocolá, Guatemala. We have already placed before our readers other inventions emanating from the same source, and expect ere long to present them with still further evidence of Mr. Guardiola's skill in devising means for the development of Central American and other productions.

The present invention relates to a novel form of evaporator and an improved means of rapidly and effectually defecating sugar juice. Its essential features are shown in Fig. 1, which represents one form of the apparatus. In this form two evaporating helices are used in combination with a receiver or defecator and two evaporating pans, all of which are heated by the furnace shown in the figure, part of the ground in which is broken away under the first pan in order to show the flue which connects the furnace with the chimney.

The peculiar construction of the evaporating helix will be better understood on reference to Fig. 2, which is a top view of the same, and to Fig. 3 where it is shown in vertical central section. The material is metal, and it is made so as to form a spiral channel, which descends gradually as it increases its distance from the center. The center, which is of course the highest part, consists of a vertical tube into which the juice is received and which is shown in detail in Fig. 5. It will be seen that the open side of the tube is provided with a gate, which is raised or lowered by a rack and pinion. By the adjustment of this gate the flow of juice into the spiral channel is regulated. The outer rim of the channel, throughout its entire length, is made so as to form a vertical wall with an outwardly projecting horizontal flange, which latter is terminated by an upwardly projecting lip; the construction is fully shown in the sectional view, Fig. 4, where A is the bed of the channel, and B is the outer rim.

Fig.2.



The horizontal flange is perforated, as represented, and acts as a skimmer; for when the juice, in its downward passage through the channel, boils over the vertical wall, it is thrown upon the flange, upon the surface of which the impurities are retained, while the purified juice falls through the holes into a lower part of the channel. Along the lowest convolution the flange is not perforated, thereby preventing the lateral discharge of the juice for obvious reasons.

GUARDIOLA'S SUGAR EVAPORATING APPARATUS.

The operation is as follows: The cane, beet, or sorghum juice passes from the mill in which it was made into steam defecators of ordinary construction, and is then elevated to and passed through suitable filters, whence it flows into a vat. From this vat, by proper connections, it is drawn into the central tubes of the two helix evaporators and skimmers seen in Fig. 1. It passes from them into the receiver or defecator, which is placed between them and the first pan. By means of a faucet in the receiver and a trough, both of which are shown in the engraving, it is thence conducted into either of the two evaporating pans, where it is brought to a density of from 25° to 30° Baumé, and rendered fit for the vacuum pan or other process. By means of the crane and dipper, as delineated, the sirup is removed from the pans and deposited in a tank for final treatment.

A separate furnace may be placed under each helix, with the flues meeting under the defecator, or a single furnace can be used under both. It is not necessary to employ two helices, as one alone would answer, though in that case the spiral channel of the one would have to be proportionately elongated. Various modifications of the helices, etc., are embraced by Mr. Guardiola's patent which also includes the introduction of a box into the bridge of the furnace for the production of hot air, should it be required for any purpose.

A large quantity of the water contained in the juice is evaporated while it is passing through the helix, and the sirup which comes out is comparatively pure. It takes but a few minutes for its passage and proper evaporation, and it is stated that the yield is greater and the quality better than in any other apparatus used for the same purpose. A boy with a rag or brush keeps the skimmer clean, and that is all the attention that part of the process requires.

Further information may be obtained by addressing Mr. Guardiola, care of Ribon and Muñoz, 63 Pine street, New York, or care of J. C. Merrill & Co., 204 California street, San Francisco, Cal.

The Drive Well.

The Hutchinson (Kansas) *News* says that a novel but highly successful expedient has been adopted by Mr. Criley, superintendent of construction of the Atchison, Topeka, and Santa Fé Railroad Company, for supplying his boarding trains and track layers with pure cold water. Providing himself with three drive wells, he placed one at the end of the track and the others along the line in advance, one mile apart. An experienced well driver was obtained in Hutchinson, and he contracted to take up, carry forward, and drive again two pumps per day, removing one after the morning's supply was obtained at the boarding train and carrying it forward one mile beyond the farthest pump. After dinner, for which the train moves forward one mile to the next pump, this pump is carried forward again to the front; and thus the men are constantly and cheaply supplied with fresh water. Excepting a few miles of the line beyond Cow Creek, one hundred miles west of Hutchinson, where the road leaves the valley and cuts off a bend in the Arkansas, striking it at Fort Dodge again, the pumps can be driven all the way to the State line, a distance of 280 miles. What other railroad line in the world can boast of a similar advantage, and where else is there so long a row of pumps?

[Toronto Monetary Times.]

Railroad Progress---That is what is the Matter with Iron.

The building of railroads in the United States is one of those marvels of the sprightlier phase of civilization developed on this continent which it astounds one to contemplate. There are now in that country 60,000 miles of lines built at a total estimated cost of $3,000,000,000, being on the average $50,000 a mile. To this immense aggregate, new lines are being added at the rate of eight or nine thousand miles annually. The new constructions last year are estimated by Mr. Poor—the author of a series of valuable statistical volumes on this subject—to have cost $275,000,000.

It would be interesting to know—though we shall never know—how far these would have contributed to promote the settlement of the United States, and to cause the increase of 25 to 35 per cent, each decade in the total population of that country.

Instead of being compelled to seek a charter from Legislature, as is the case in this country, nearly all of the States permit the formation of railroad companies under a general act, so that any body of men, of the requisite number, upon filing articles of association with the proper State officers, become a corporation, and are invested with full authority to construct a railroad upon any route they may select. This is giving full effect to the law of competition; and loose as such a statute appears, it seems to have operated so satisfactorily that nearly all of the States, one after the other, have adopted it. It is claimed on behalf of this plan that the fear of competition is always before the eyes of railroad owners, who, therefore, are the more careful not to use their position so as too flagrantly to damage the interests of the public.

In any light that it is possible to view the subject, it will be seen that the American railroads have been a most profitable investment. This might be abundantly established by citing the incidental advantages arising from them; they give an immense demand for labor—the uneducated labor which usually emigrates in the greatest quantities; supply an immense carrying trade in materials and supplies; open up the wilderness for settlement, and thus attract population and all the concomitants of civilization; increase the value of property, and so by spreading taxation over a wider field lessen greatly its pressure upon individuals. By all these and many more considerations, it might be demonstrated beyond a doubt that these works give a handsome aggregate

Fig.3

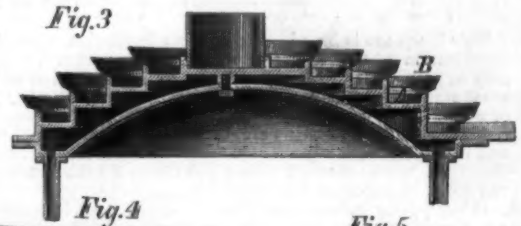


Fig.4

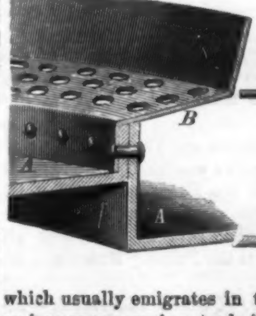
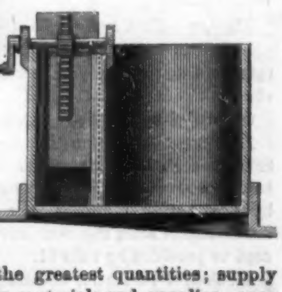


Fig.5



though indirect return on their outlay. But it is not necessary to prove by this class of arguments how profitable is the investment of three hundred millions in American railways. In 1871, the 60,000 miles of lines earned $455,000,000, or at the rate of $7,500 per mile. Taking the estimated cost at $50,000, we find that the lines earned a sum equal to 15 per cent per annum on their cost. If we assume the working expenses to be 50 per cent, then the average dividend paid on the capital invested would be 7½ per cent per annum. But the financial prospect is even better than these figures indicate. Every year the traffic is rapidly increasing; in the decade from 1861 to 1871 the tunnage carried increased at no less a rate than 33 per cent per annum. And it is from tunnage that two thirds of the entire receipts are derived.

After the figures that we have given above, it will scarcely be necessary to ask: What is the matter with the iron market? Every car shop, rolling mill, and forge in the States is calling out for supplies which reach them too slowly to keep up with the demand. Russia is adding largely to her lines every year; France is replacing those lost by the war and building new ones. Canada's annual bill for railroad iron is beginning to assume considerable proportions; some other countries swell largely the demand, so that the question, "What is the matter with iron?" is pretty satisfactorily answered.

Recent Decisions by the Commissioner of Patents.

IMPORTANT DECISION IN RELATION TO THE RENEWAL OF APPLICATIONS UNDER THE ACT OF JULY 8, 1870.—REJECTED APPLICATIONS, NO MATTER HOW OLD, MAY NOW BE REVIVED.

Gordon.—Telegraph Wire.—Appeal.

LEGGETT, *Commissioner:*

This invention consists in inclosing a telegraph wire in a non-conducting covering formed of strands of fibrous material, saturated, if desired, with non-conducting substance, the strands being "laid up," as in rope making, and the whole coated with gutta percha, the objects being to strengthen and insulate the wire, and at the same time leave it flexible. The claims are first, the described method of insulating; second, the employment of fibrous strands "laid up" to give longitudinal strength; and, third, in such a cable, the use of gutta percha as an insulating substance.

The original application was filed by the inventor, Wm. Gordon, May 13, 1848, and was once rejected the same year. In 1863, his administrator, the present applicant, filed an amended specification and claim, which was rejected by all the tribunals of the Office and finally, on appeal to Judge Cartter of the Supreme Court of the District of Columbia, June 1, 1866, for want of novelty. Under the act of July 8, 1870, the present application was filed, which has been twice rejected by the Principal Examiner upon references, and appealed to the board.

A majority of the board take the ground that, so far as the Office is concerned, the question raised by the present application is *res adjudicata*, and they affirm the decision of the Primary Examiner *pro forma*, in order that, if the case is to be reconsidered at all, it may be by the tribunal which rendered the final decision against it. The minority opinion is that the question presented on appeal is a proper one for the board under the act of 1870, and it proceeds to consider the references and decides them insufficient. The majority of the board assume that the present claims are substantially those of the application of 1863, rejected by Judge Cartter, but those claims are missing from the record.

The argument of applicant denies that this case is *res adjudicata*, and asserts that it is a new case, and must stand upon its merits; that the strict rules of courts should not be followed by the Office; but even if they are, a subordinate tribunal may send a question a second time before an appellate tribunal when an error has been committed, as in this case. On the supposition that the present claims are substantially those rejected on appeal, the references are reviewed to show that they are impertinent, and a brief review of the old law is submitted showing that the practice has been to rehear applications after rejection. The question for the Commissioner seems to be simply whether an application filed and rejected in 1848, renewed in 1863, and rejected for want of novelty on appeal to the court in 1866, can be renewed and treated on its merits by the Office under the act of 1870; and if not, then whether it should be rejected *pro forma* and allowed to go to the court. The Examiner assumes the former, and the board, the latter.

The language of the act of 1870 is, that—

"When an application for a patent has been rejected or withdrawn prior to the passage of this act, the applicant shall have six months from the date of such passage to renew this application or to file a new one."

This language is broad. It places no limitation upon the signification of the word "rejected," which makes it necessary or proper for the Commissioner to inquire when or at what stage of proceedings a rejection occurred, whether in or out of the Office.

All renewed applications are, in one sense, *res adjudicata*, and it was to reach adjudicated cases and provide a remedy that the law was enacted. I see no ground for the action of the board in rejecting this application *pro forma*.

It is properly before the Office for action upon its merits, and should be so considered by the board.

The case is ordered to be returned to the board for such examination.

Farrow.—Thill coupling.—Appeal from the decision of the principal examiner, who held that every element that enters into the construction of a device must be mentioned in the claim.

Overruled by the Acting Commissioner, Thatcher.

Hammond.—Swaging Drop.—The applicant, in his appeal from the Primary Examiner to the Examiners-in-Chief, introduces several important amendments to his claims. Held by the Acting Commissioner that rule 43 precludes all amendments after the case leaves the Primary Examiner, except as provided by rule 61.

McDougal vs. Eames and Seely.—Carbolic Compounds.—Interference.—Decision of the board of Examiners-in-Chief reversed and priority of invention awarded to Eames and Seely. In this case, Commissioner Leggett says: "McDougal's patent of 1867, so far as it describes a soap, ought never to have been granted without an interference with the patent of Eames and Seely, which was issued on the very day that McDougal's application was filed. A little more care, upon the part of the Examiner at that time, would have saved the Office from a great amount of vexatious labor, and the parties from thousands of dollars of needless expense.

Butterfield.—Imitation button and button hole for leather work.—Decision of the Primary Examiner overruled. Held by the Commissioner:—"A device which is cheaper and more durable, although its novel feature is for ornamentation, is patentable as an article of manufacture when intended as a substitute for an article both useful and ornamental."

McClellan.—Fare-box for cars.—Appeal from the Primary Examiner, who held that the words "or their equivalents" must be erased from the claim. Decision of the Examiner overruled by the Acting Commissioner, Thatcher.

Allen.—Tube Joint.—Extension.—Held by the Acting Commissioner that any new matter found in the reissued specification was improperly allowed, and must be stricken out before an extension can be granted.

Corban.—Spring for watch cases.—Appeal.—The Board of Examiners-in-Chief being unable to perceive the novel and useful points in this case, Commissioner Leggett, on appeal, comes to the rescue, points out the patentable features, reverses the decision of the Board, and orders a patent to issue.

Packer.—Hand Drill.—Extension.—Held by the Acting Commissioner, Thatcher, that where a patent has been reissued by the patentee, the application for extension must be made upon the reissued patent and not upon the original patent.

A New Steam Street Car.

The Utica *Herald* gives the following account of the recent trial of a new steam street car at Ilion, N. Y.:

This car appeared at the first glance to differ not at all from the ordinary street car. Closer inspection revealed the fact that one platform was a trifle longer than the other, and could not be gained from the inside of the car. In the space ordinarily used as a doorway stood the compact boiler and engine. All the machinery does not occupy more space than an ordinary, modern base-burning parlor stove of the larger size, and does not use one foot of passenger room. The engineer stands upon the platform, occupying the place of the driver.

The engine, perfected by William Baxter and now in use at Ilion, is made on the principle of the English compound engine, in use on ocean steamers. It has two cylinders, and drives the car by direct crank connection without any intermediate mechanism. The steam is admitted from the boiler to the first cylinder, which is smaller than the other and which is, in fact, a "high pressure" cylinder. It escapes from this to a chamber formed by a jacket around the boiler, where it is superheated, and then it is used in the larger cylinder. As it finally escapes, it is reduced to about atmospheric pressure. By this means the entire force of the heat is used, and economy of fuel as well as of space for the boiler is obtained. The engine is arranged to consume its smoke, and with the low pressure of the exhaust both soot and noise are avoided. The engine, as ordinarily run, is a five horse power engine, and will take a load of thirty or more passengers over a reasonably level track at the rate of fifteen miles an hour, at least. The engineer can instantly and at pleasure throw the steam from the boiler directly into both cylinders, and give his engine, for the time, twenty-five horse power. It thus takes its load easily, and not without retarding its speed, up grades of four hundred feet to the mile. It is, in fact, a five horse power engine, with power to increase its power five times, without stop and without loss of speed. Having no gearing, cogs, or intermediate mechanism between the engine and the crank of the drive wheel, there is comparatively no danger from disarrangement in that quarter. The outer jacket of the boiler is shut in from the body of the car by a wooden screen through which no heat passes at any time. The exhaust in the summer goes under the car. In the winter it is taken through the car by pipes, which give give moderate but equal temperature to the atmosphere. Mr. Baxter has embodied in this engine another feature, by which the objections to reversing the engine are entirely done away. Running at the rate of six miles an hour, he stops the loaded car in eight feet. Going at the rate of twelve miles an hour, he stops in thirty-two feet. The great economy in steam gives equal economy in fuel, so that coal is consumed at the low rate of one tun to the thousand miles. As nothing precedes the car, all the windows can be opened without trouble from dust. Smoke, there is none; there is nothing to raise dust except the car itself, and what dust it raises is under the car and left behind. When the car is in motion, the front windows can be opened, and a refreshing breeze is felt, with none of the ordinary discomforts.

About twenty persons started from Ilion on Saturday; but before the ride was over, the number was more than doubled. The party rode first to Frankfort, dashing out of Ilion at a lively rate; but slowing just as the car seemed in imminent danger of running into a horse car which it overtook. The engineer seemed to have perfect control of the car, and handled it by steam far more easily than it could have been done by horseflesh. The road from Frankfort to Ilion needs some leveling, and the curves especially need attention, the outer and inner rails being often on a level; in some few places the inner rail was apparently the lowest. The real test came in going over the canal bridge between the villages. The bridge is reached on either side by a grade of about eight feet in one hundred, and the immediate approach to the bridge, each side, is by a very sharp, bad curve.

It will be seen that the combined curve and grade made this a bad place, but we rode safely up the grade, around the curves, and down again, and gaily away to Frankfort. The return from Frankfort to Ilion was made at the rate of fifteen miles an hour, in spite of rough roads, curves and grades.

After reaching Ilion, the car was run over a track still rougher than the first, but without grades, to Mohawk and return.

During the afternoon, the car met or overtook in the road, at no place very wide, from fifty to one hundred horses, without an accident, so far as we learn.

Refrigerator Cars.

The heat of the summer months does not prevent the shipment of Western produce to Eastern cities. The Blue Line Freight of the Michigan Central and Great Western Roads make a specialty of this class of traffic during the warm season, and guarantee to deliver butter and fresh meat at Eastern markets in as good condition as when received for shipment here. They use refrigerator cars both of the Sutherland and Davis patent. These are, without doubt, the best of the kind. The outside does not differ in appearance from other freight cars, with the exception of not having end windows and grated doors, and they are a little heavier. The Davis cars, which we examined, had been running about five years, almost exclusively in the beef trade. The floor is double, with heavy matched flooring; the sides are made airtight with a lining of zinc, which stands off six inches from them, this space being filled with ice and salt, the ice broken in pieces about the size of an egg; the doors are of the same thickness, are double, and open into the car; the space within the doors is filled with charcoal and sawdust; an additional door of plank is outside of this, and when the car is loaded the space between the two doors is filled with sawdust. Fastened to the ceiling of the car with staples are iron rods, about three quarters of an inch in diameter, placed about one foot apart, longitudinally, from which the meat is suspended by means of hooks. A car will carry about 120 beef quarters, weighing in the aggregate from 16,000 to 20,000 lbs. A wooden rack extending about the sides of the car prevents the meat from swinging or resting against the zinc. The Davis car requires about four tuns of ice to render it a perfect ice box, and this is replenished at Detroit, Suspension Bridge, and Albany, and meat shipped in this manner brings the highest price in the Eastern markets.

The Sutherland car is built with packed sides of charcoal and other ingredients, to render it impervious to atmospheric influences. The casing is about six inches thick, and the interior lining is of zinc, the same as the Davis car; the ice is placed in a rack at each end of the car, and above the racks are openings in the roof to replenish the ice; a door drops from the roof of the car to the edge of the rack, which serves to retain the ice in its place; a conduit pipe carries off the water, none of which is allowed to stand on the floor. A rack will hold one tun and a half of ice, or three tuns to the car—one tun less than is required by the Davis method, and without the extra trouble of breaking it into small pieces. The Sutherland car shown to us was used for shipping butter. The kegs and firkins are piled up two thirds the hight of the car, between the racks; the doors are closed in the same manner as in the Davis cars, and the ice is replenished at the same points.

Judging from the quantity shipped East, we are justified in supposing that "Western grease"—which the Eastern dames are pleased sometimes to call our butter, as they peer at it over their specs and punch it with a parasol—is far more palatable than was supposed, and it now finds an appreciative market. In the freight depot, foot of Lake street, a long room is partitioned off; the space, four feet wide, between the outer brick wall and the interior board lining, is filled with ice; inside the room the butter kegs and firkins are piled up, and as soon as a car load has accumulated it is at once loaded and started eastward. The additional expense of running a refrigerator car from Chicago to Boston is about $30, and rates are the same as with ordinary freight cars; the shipper runs no risk; if his goods are in perfect condition when loaded, he can rely on finding them so when unloaded. And in regard to beef, he pays rates on that which is clear profit to him, without the extra freight on horns hide, and hoofs, when live cattle are shipped.—*Chicago Railway Review.*

THE great globe which we inherit is itself a magnet. On the one side of the magnetic equator, the north end of the needle dips; on the other side, the south end dips, the dip varying from nothing to ninety degrees. If we go to the equatorial regions of the earth with a suitably suspended needle, we shall find there the position of the needle to be horizontal. If we sail north, one end of the needle dips; if we sail south, the opposite end dips; and over the north or south terrestrial magnetic pole the needle sets vertical. The south magnetic pole has not yet been found, but Sir James Ross discovered the north magnetic pole on the 1st of June, 1831.—*Faraday.*

THE Nassau Gas Light Company is the title of a new corporation in Brooklyn, N. Y., for the supply of street gas. Its works are quite extensive. The gasometer is located at the corner of Keap street and Myrtle avenue. It will have a capacity of 385,000 cubic feet, adequate in all respects to receive and discharge the one million of cubic feet to be daily manufactured. The dimensions are: elevation 50 feet and diameter 104 feet. The retort and purifying house will be equal to the production of 2,000,000 cubic feet per day.

WRITING INK.—Adding a solution of yellow prussiate of potash, to any ordinary black ink, renders it incapable of being removed or altered. Oxalic and other acids convert it into Prussian blue.

HOW FELT HATS ARE MADE.

There is a legend among the hatters that felt was invented by no less a personage than Saint Clement, the patron saint of their trade. Wishing to make a pilgrimage to the holy sepulcher, and at the same time to do penance for sundry unexpiated peccadilloes, the pious monk started on his journey afoot. As to whether he was afflicted with corns or kindred miseries, the ancient chronicle from which this information is derived is silent; but, at all events, a few days successive tramping soon began to blister his feet. In order to obtain relief, it occurred to him to line his shoes with the fur of a rabbit. This he did, and, on arriving at his destination, was surprised to find that the warmth and moisture of his feet had worked the soft hair into a cloth-like mass. The idea thus suggested he elaborated in the solitude of his cell, and finally, there being no patent laws in existence in those days, he gratuitously presented to his fellow mortals the result of his genius in the shape of a felt hat.

The fur principally used at present in the manufacture of felt hats is that of the Russia hare or "coney." Hunting this animal is a favorite winter sport among the Russians, who pursue their game on horseback, killing it with a single blow of their long whips. Three kinds of the fur are known in commerce, termed back, belly, and side Russia, the latter being the finest.

The first process the fur undergoes is "carroting," which consists in applying to it a solution of mercury and *aqua fortis*, the object being to render its felting easier. The skins are then hung in a hot room until dry, when the fur is removed, sorted into the qualities before mentioned, and finally made up in bundles and sold by the pound, the price varying from about $1.50 to $5.00.

The fur, as it is taken from the bundles, is mixed, and fine carded cotton added in the proportion of ½ oz. to ¼ oz. of cotton to 4 or 5 oz. of fur, that being the usual quantity required for a single hat. This mixing is done by a picking machine into which the material is fed. It is then immediately seized by a toothed picker which revolves with great velocity, creating a strong current of air, thus agitating the fur and cotton in the top of the box above the machine. This process is repeated by the mixture falling on an endless belt which conducts it to another picker.

The "stock," as it is now termed, is next passed through a machine which contains a number of rollers on which are short metal teeth. There is an opening of about an inch in width before each roller, and one at each end. The fur being carried to the rollers, on a broad belt, is subjected to their action, by which the coarse material and impurities are made to fall through openings in the bottom into boxes underneath, while the finer portions are forced to the top of the machine and out at its further extremity. The stock, which in technical parlance is now said to be "blown," is next weighed into quantities sufficient to form the desired number of hats of similar weight. It is then spread upon a broad belt and passed into the forming machine, an apparatus made of boiler iron and resembling a snow plow in shape.

A quantity just sufficient for one hat body is placed on the feeding apron of this machine. It is drawn in, between two horizontal feeding rollers covered with felt, and immediately seized by a cylinder which revolves about 3,000 times in a minute, and which is furnished with several longitudinal lines of stiff brushes. This generates a current of air which scatters the stock and blows it out of a vertical slot in the apex of the machine. The thin stream thus ejected strikes against a revolving copper cone which is thickly perforated with holes. A current of air, caused by an exhausting fan revolving with immense velocity under the cone, creates a suction which draws the fur closely to its surface. When the stock in the machine is exhausted, a wet cloth is placed over the cone, a metallic cover slipped over that, and the whole plunged in a tank of hot water. The mat is now removed from the cone, as the felting has begun to take place. This, as our readers are probably aware, is due to the fact that all fur is barbed, from root to point. As the hairs are thrown on the cone in every possible direction, they become interlaced, so that by warmth, proper moisture, and manipulation, they may be made into a firm close fabric.

Each body is first inspected in order to detect thin spots, which are strengthened by causing small portions of stock to adhere by the aid of hot water; then it is gently worked and rolled in a piece of blanket, and finally packed in the bale, twenty-four dozen at a time. It is in this condition that the body reaches the hatter, who sends it to the sizers. The sizing kettle or "battery" is constructed of copper, and, in large establishments, heated by steam. Around its edge are arranged eight planks, one for each workman. These planks are some ten feet long and eighteen inches wide, and are sloped at an angle to the kettle, to the edge of which they are fastened. The principal tool of the operator is a rolling pin some eighteen inches long, pointed at both ends and marked with rings for measuring. His hands are protected by "gloves" or thick pieces of sole leather covering the palms. Taking two or three bodies at a time, he plunges them into the boiling water, and then kneads them until a sufficient shrinkage in their dimensions takes place. Then he takes a single body and rolls it with his pin until it assumes the proper size, form, and consistency, and then, after allowing it to dry, pares off all its inequalities with a large sharp knife, made especially for the purpose.

Stiffening is the next process. The material is gum shellac, dissolved in boiling water by the aid of alkalies. Across the top of the tub in which it is contained are two rollers turned by a crank and pressed by the action of a weight closely together. The body, after being dipped to the depth of the brim, is passed quickly through the rollers; then it is refolded, the brim again dipped, again passed through, and this process is repeated several times. The crown of the hat is not dipped, as it gathers sufficient stiffening from that adhering to the rollers. When dry, the body has little resemblance to a hat. In fact, it is simply a wide mouthed bag, with a small rounded end and stiff edges. It is necessary, therefore, to begin to mold it into shape. A workman, termed a "blocker," is furnished with hat blocks and a trencher or small copper plate, four inches long and three inches wide, pierced with a hole in the center large enough to admit the thumb. After soaking the body in boiling water until it is soft and pliable, the operator places it upon a block and shapes it with his trencher, continually pouring hot water over it to keep it in proper condition.

The hat thus roughly modeled is now ready for coloring. If it is to be black, it is soaked in a dye of logwood, verdigris and copperas. It is not left permanently in the kettle, but is removed from time to time and suspended in the air, the effect being to deepen the color. This process occupies about twelve hours. The fancy colored dyes are prepared with mordants. Washing follows, and then the hat is reblocked and its size determined and indicated by notches made in the edge of the brim. Pounding or rubbing the surface smooth with fine pumice is generally done by hand; then the hat is ready for the finisher.

Each hat being placed upon its proper block and kept in position by a fine though strong cord, its surface is wetted and a hot iron drawn around it in the direction in which the nap is to be. Then the brim is trimmed to proper shape and curled according to the fashion. The lining is put in by girls, and finally the hat is ironed, packed in a nest of half a dozen in paper bandboxes, and thus supplied to the retail trade.

ADULTERATION OF CHEMICALS.

Acetic acid is frequently weakened with water and adulterated with sulphuric ether. Six samples tested with chloride of barium gave a precipitate of sulphate of barium in varying proportions.

Muriatic acid and sulphuric acid, sold as chemically pure, have both been found contaminated; the former with arsenious and sulphurous acids, the latter with a large proportion of sulphate of lead.

Tartaric acid has been met with containing 50 per cent of sulphate of magnesia. Alum is also said to be used as an adulterant, but the reporter had not met with a specimen.

Alum frequently contains iron, probably arising from carelessness in the manufacture. The presence of free acid has also been noticed, especially in the English article.

Carbonate of ammonia is sometimes substituted by a compound made from solution of ammonia, glue, and bicarbonate of soda, which forms when dry a hard translucent mass, resembling genuine carbonate.

Muriate of ammonia is sometimes met with of very poor quality; iron is often visible on the surface and becomes still more so when dissolved. The report recommends that the purified granular salt should be the only one sold at the dispensing counter.

Black sulphuret of antimony has been met with containing sulphite of lead (galena), quartz (30 to 40 per cent), clay, etc. A good article, however, is procurable.

Powdered arsenic is sometimes adulterated with sulphate of lime or sulphate of baryta; the pharmacist is, therefore, recommended to purchase the lump arsenious acid.

Bismuth (metal) generally contains arsenic. An instance is mentioned in the report where 400 lbs. of antimony were sold by a broker to a manufacturer for bismuth. Fortunately for the latter, he detected the error before the transaction was completed.

Subnitrate of bismuth has been reported as adulterated with 20 per cent of phosphate of lime; but it is believed that the salt made in the United States by the principal manufacturers is free from adulteration.

Citrate of iron and quinine is seldom found made strictly according to the United States formula, which does not produce a sufficiently soluble salt. Some manufacturers, therefore, add citrate of ammonia to make it soluble, and others leave out a considerable portion of the quinine to accomplish the same end. There is also a probability that in some cases cinchonine is substituted for the quinine.

Chloral hydrate has been met with containing the alcoholate. The tests pointed out are the difference in boiling point, sulphuric acid, which leaves pure hydrate colorless but turns alcoholate brown, and nitric acid, which gives little or no reaction with hydrate, but reacts violently with alcoholate, giving off nitrous oxide gas.

Chloride of calcium has been noticed at Chicago with a large excess of caustic lime, and it is known to have been sold in crystals without any allowance made.

Chloroform is sometimes met with diluted with alcohol, and sometimes not sufficiently purified, and, therefore, unfit for inhalation. There is also reason to believe that partially decomposed chloroform has been sold through ignorance on the part of the dispenser. Nitrate of silver is useful in detecting this decomposition, by giving a precipitate of chloride of silver with the liberated chlorine.

Cream of tartar is grossly adulterated, and the distinctive terms are said to be well known to mean varying proportions of *terra alba* and cream of tartar.

Epsom salt has been substituted in the Western market by finely crystallized Glauber's salt. As the prices, however, are now about the same, this is not likely to recur.

Ether is sometimes sold containing a large proportion of alcohol. This may probably arise from the druggist dispensing photographic concentrated ether, made to contain alcohol in order to dissolve the gun cotton.

Iodoform has been noticed of a light canary color, a considerable portion being insoluble in ether; probably iodate of lime.

Acetate of lead has been in the market containing a large percentage of crystallized nitrate of lead; one lot was offered to a maker of preparations for the hair as "damaged," which proved to be damaged sulphate of zinc, in lumps.

Precipitated carbonate of lime has been offered containing sufficient iron to give it a light fawn color; supposed to be ordinary chalk, dressed.

Sulphate of morphia is frequently open to suspicion. In one case the sample did not contain any morphia; placed on a red hot plate, it did not seem to lose any weight, and it was insoluble in water. A fraud in which sulphate of quinine was put into sulphate of morphia bottles has been lately detected in New York.

Phosphorus, according to Dr. Rademaker, sometimes contains arsenic.

Bromide of potassium has been observed to contain a considerable quantity of water of hydration.

Iodide of potassium is often adulterated with the bromide; some made in New York was found to contain carbonates in considerable quantity.

Sulphate of quinine has many adulterants, among them sulphate of lime; cinchonine, sold as "sweet quinine" or as "cinchoquinine;" muriate of cinchonine, sold as "light sulphate of quinine" and as "French quinine," salicine, etc.

Rochelle salt has been offered for salt containing at least 25 per cent of sulphate of soda.

Santonine was seen last year, in the New York market, contaminated with small particles of mica. This fraud may easily be detected by placing the suspected sample on a hot plate; the santonine will disappear and leave the mica.

Nitrate of silver (made for the Government), which contained five per cent of copper, was sold in Chicago. Pieces could be picked out emerald green in color; it appeared to have been made by simply dissolving coin or other alloy of silver in nitric acid, and crystallizing without any attempt at purification.

Precipitated sulphur is reported as usually free from sulphate of lime, and the United States pharmacist is congratulated on this superiority to the English article, but a proportion of 50 per cent of gypsum in flowers of sulphur is reported as having been noticed, and sometimes ground sulphur is sold for the sublimed.

Tartar emetic has been met with containing 11 per cent of cream of tartar.

Spices, on account of their widely extended use, are largely adulterated, and some startling revelations might be made if a spice miller could be persuaded to disgorge his ill-gotten knowledge. The only safe way to get pure powdered drugs is to pay a good price, and buy from conscientious persons who are above suspicion.

Cochineal is adulterated with sulphate of barytes, a heavy white powder, which, when shaken with the insects, lodges in the wrinkles and crevices on the surface of the body. The weight is thus increased sometimes from 15 to 25 per cent.

Balsam of copaiba is often mixed, and sometimes found entirely fictitious, being composed of a mixture of castor oil, resin, and oil of copaiba. Powdered ipecacuanha is sometimes so adulterated and weakened that tartar emetic is necessary to strengthen it. Oil of lemon mixed with 30 per cent of fixed oil has been met with.

Powdered opium is often mixed with powdered extract of liquorice. In fact, some dealers uniformly send to the grinders a certain proportion of liquorice with the opium, so that they might be ground together. Powdered rhubarb is frequently adulterated with curcuma. Sometimes senega root is mixed with cypripedium.

Castile soap frequently contains an undue proportion of water. It has been met with containing as much as 30 per per cent. Acetic acid is also mixed with water, acidulated with dilute sulphuric acid.

Subnitrate of bismuth has been found mixed with phosphate of lime to the extent of 20 per cent; and citrate of iron and quinine is adulterated with citrate of ammonia, and contains less quinine than called for, 10 or 15 per cent instead of 25 per cent. Quinine itself is frequently met with mixed with cinchona, muriate of cinchona, and salicine.

Santonine has been found adulterated with small particles of mica, and cream of tartar frequently mixed with tartar emetic. Cream of tartar is grossly adulterated; the terms "strictly pure, pure No. 1 and No. 2," being used to indicate varying proportions of cream of tartar and *terra alba*, the latter material being largely imported from Europe for the express purpose of adulterating, the importations amounting to many tuns annually.

Chloroform is sometimes diluted with alcohol, and iodide of potash in crystals mixed with bromide, and occasionally with bicarbonate of potash. Solid extracts are also much adulterated.

In the manufacture of sirup, a considerable portion of the sugar is replaced by glucose, especially in making fruit sirups.—*Proceedings of the American Pharmaceutical Association.*

WHETHER we see rightly or wrongly, whether our intellection be real or imaginary, it is of the utmost importance in science to aim at perfect clearness in the description of all that comes, or seems to come, within the range of the intellect. For, if we are right, clearness of utterance forwards the cause of right; while, if we are wrong, it ensures the speedy correction of error.—*Tyndall.*

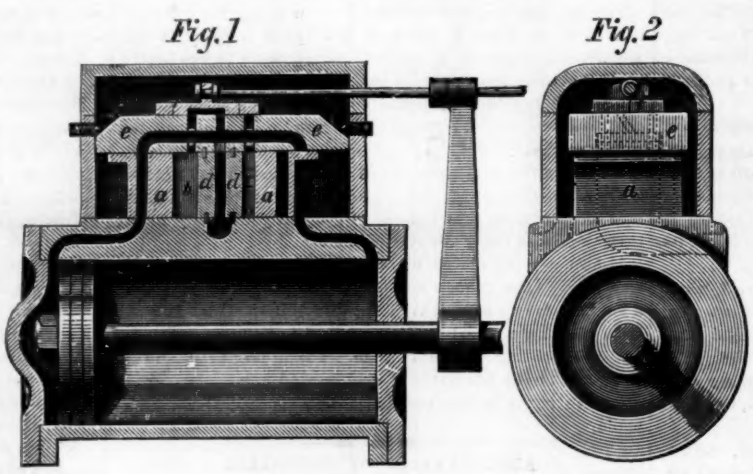
NEVER use a hard word when an easy one will answer as well.

DIRECT-ACTING STEAM ENGINE.

The invention which forms the subject of this article is applicable to that class of steam engines known as direct-acting, and the improvements consist in a peculiar form of steam valve and piston, which is packed tight enough by steam pressure to prevent leakage, and is yet sufficiently relieved from the same to insure ease in running and certainty in action. It is, at the same time, of simple construction, is easily accessible for repairs, and admits of accurate adjustment.

Fig. 1 is a central longitudinal section, and Fig. 2 is an end view, with the end of the valve chest removed.

The steam valve is shown at *a*. Its bottom sides operate the ports of the cylinder by connecting each, alternately, with the steam in the chest and with the exhaust passage, the latter being effected by means of the vertical passage through the valve, as shown, and their connections. In the center of the valve, *a*, is a chamber, the two ends of which are shown at *b* and *c*. In this chamber is placed the exhaust port, *d*, the passage up the center of which forms a communication between the main exhaust and the exhaust passage in the plate, *e*. The exhaust port, *d*, fits the sides of the the chamber, *b c*, and is the same hight as valve *a*, so that when the plate, *e*, is in place, the two parts of the chamber, *b* and *c*, may be alternately filled with and exhausted of steam by means of the supplemental valve, *f*. The valve, *a*, and the exhaust port, *d*, are ground to fit the top of the cylinder and the plate, *e*, and all the parts are then accurately adjusted by means of the screws which may be seen passing through the ends of the valve chest in Fig. 1. The ends of the plate are beveled, and the screws have their bearings in the center of the bevels, thus allowing the plate to move sufficiently to make the adjustment, notwithstanding ordinary imperfections in the construction of the parts. The ports of the supplemental valve, *f*, pass through the plate. The various passages for steam and exhaust cannot be shown in full detail in the engravings, but their course will be readily understood from the following description of the operation of the engine, taken in connection therewith.



BENSON & AVERY'S DIRECT-ACTING STEAM ENGINE.

In Fig. 1, the piston is supposed to have finished its stroke to the left, and to have carried the valve *f*, into the position shown; under which conditions steam is admitted through a port in the plate, *e*, into the end of the chamber, *c*, and at the same time steam from the other end of the chamber, *b*, is permitted to escape, by means of passages through the plates and the cavity, shown in the valve, *f*, to the main exhaust port. The effect of the foregoing is to force the chambered valve, *a*, to the right, and thereby to connect the right hand cylinder port (through the passages in the valve and plate) with the exhaust port, *d*; at the same time and by the same motion of the valve, *a*, the left hand cylinder port is opened to the steam chest, and a reversal of the engine is effected.

The improvements were patented June 4, 1872, and further information may be obtained of the inventors, H. A. Benson and William Avery, of Warren, Mass.

Cutaneous Absorption of Poisons.

In a recent note to the Paris Academy, M. Bernard describes a series of experiments for the purpose of testing the degree of cutaneous absorption which took place in a bath impregnated with the substances to be tested. Every precaution was taken to prevent the possibility of the substances entering the system of the patient by any avenue except the skin. He was then submitted for a short time to steam vapor charged with iodide of potassium, and two or three hours afterwards the urine gave unmistakable evidence that the iodide had been absorbed and was passing through the system.

In these experiments the medicinal agent reached the skin in hot aqueous vapor, and therefore acted more readily than an ordinary cold solution; but the fact of cutaneous absorption was very definitely illustrated. M. Bernard adds:

"M. Colin has described an experiment in which he allowed water charged with cyanide of potassium to fall for five hours on a horse's back. This caused the death of the animal; the sebacious (fatty) matter having been destroyed through percussion, and cutaneous absorption taking place.

The Study of Nature as a Means of Intellectual Development.

Some affirm that the study of natural science is fatal to the development of our higher emotions, and tends towards gross utilitarianism. But who can study the harmony existing in the works of Nature, the manifest order and design displayed in endless changes and variety, and the immutable laws which govern the physical world, without having his thoughts and aspirations lifted to Him who inhabiteth eternity, the Alpha and Omega? "The heavens declare the glory of God! Day unto day uttereth speech, night unto night showeth knowledge!"

Astronomy writes, in the motions of the stars, poetry more glowing than human pen ever produced. Botany leads us among the flowers, the most unpretending of which is arrayed in glory greater than that of Solomon and teaches Divine goodness and love to every thoughtful observer. Chemistry, unfolding to us wonderful and mysterious changes, excites not only emotions of beauty but of sublimity. And what shall we say of that marvellous agent, vital force, which still eludes the analysis of the latest science? In autumn it withdraws its power and all Nature is clad in the habiliments of decay and death. In the spring time, with magic hand, it robes the earth in living beauty.

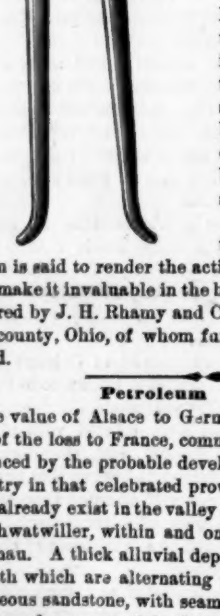
Adding, to a thorough knowledge of any one science which might be chosen as a particular field for research and study, a knowledge of the most important principles of the others, we have sufficient matter for the development of the most susceptible and retentive memory.

By constantly observing facts, drawing conclusions from them, and verifying these conclusions by observation or experiment, we form the habit of correct reasoning, and thus gain the same kind of discipline which geometry or any other abstract science affords. Nor is discipline alone the result of the study of Nature as is often the case in absolute sciences. Nature rewards her students not only with discipline but with knowledge the most practical, pleasurable and profitable.—*Rhode Island Schoolmaster*.

BLACKSMITH'S BUTTERIS.

We illustrate in the annexed cut John H. Rhamy's improved butteris, patented June 11, 1872, which appears to be a very good tool for the purpose intended.

It is constructed of three levers which are combined, in the manner shown in the engraving, so as to obtain considerable power in the jaws of the implement. The jaw on the left is provided at its end with a steel paring knife, and the right hand one forms an anvil block and projects considerably beyond the front of the knife.



In practice, the projecting portion of the right hand jaw is made to rest against the horse's hoof, and the paring knife is put in operation by compressing the handles of the levers. As the knife approaches the block, it pares off the hoof and also cuts off the nails therein, thereby performing the double duty of butteris and pincers.

On the left of the tool is shown a thumb screw, which passes through the arm of one lever and presses against the one immediately opposed to it. By adjusting this thumb screw, the distance between the jaws is regulated and the blade of the paring knife prevented striking the face of the anvil block and thereby becoming dulled. The latter is preferably made of copper or other soft metal.

The increased leverage obtained in the arrangement shown is said to render the action of the tool so sure and easy as to make it invaluable in the blacksmith's shop. It is manufactured by J. H. Rhamy and C. W. O'Neal, at Findlay, Hancock county, Ohio, of whom further information may be obtained.

Petroleum in Alsace.

The value of Alsace to Germany and the consequent extent of the loss to France, commercially considered, are alike enhanced by the probable development of a large petroleum industry in that celebrated province. Oil works on a small scale already exist in the valley of the Rhine, near the village of Schwatwiller, within and on the borders of the forest of Hagenau. A thick alluvial deposit has first to be penetrated, beneath which are alternating strata of indurated clay and micaceous sandstone, with seams of compacted sand. These last named seams contain the petroleum, and are found at a depth of seventy or eighty yards. Indications of the presence of petroleum are observable in various parts of the forest and bitumen is found and worked in the adjacent country. Borings to test the presence of the petroliferous sand have been multiplied to some extent, and in all cases with satisfactory results. The mode of working very much resembles that of a colliery, only on a much smaller scale. We believe that at present there are only two oil pits existing, and one of these is of very recent date. In fact the whole affair is in its infancy, but is most likely destined to undergo very great extension, so as to become of considerable importance. The pits are sunk in the ordinary way, and the seams of sand are worked by means of galleries, in a manner similar to that of getting coal. As the workmen cut their way through the compacted sand, the oil oozes out of it, running down the walls of the gallery on to the floor, where it accumulates in shallow wells dug for the purpose. From these wells the crude petroleum is conveyed to the surface to be properly treated. But this process of draining does not remove all the oil, and the sand itself is accordingly taken to the surface to be distilled in retorts. The crude oil which oozes from the sides of the gallery, and that which is distilled from the sand, are subsequently rectified by a further distillatory process, and the product is understood to be in no degree inferior to the best American petroleum. In working the existing pits, it is a singular fact that no water is met with. Of the extent to which the petroliferous sand prevails, it would be premature at present to judge, but there seems no reason to doubt its presence over a considerable range of ground. Now that attention has been drawn to the subject, we may expect further discoveries will be made. It is reported that Mr. Keates, the well known analytical chemist, has recently visited the oil producing district in Alsace, and examined the works. So far as we can learn, there is every prospect of the oil proving abundant. The cost of production, it would seem, is so moderate that the competition of American oil need not be feared, and the demand is such that Alsace will consume all she raises for some time to come, unless the produce is very largely increased.

It has been said that petroleum, as found in different parts of the world, is not confined to any particular stratum, and that consequently there is no such thing as a "petroleum rock," properly so called. Petroleum has been found in rocks of all ages, from the lower silurian to the tertiary period inclusive. The oil wells of the United States are for the most part sunk in the sandstones which form the summit of the Devonian series. The oil of Alsace, it will be observed, is limited to certain seams of compacted sand, and it would appear that in this region the oil is found solely in these seams It is a general theory, with regard to the origin of petroleum, that it has been produced by the slow distillation, at low temperatures, of coal and other bituminous minerals. The theory would seem to accord with the fact, already named, that bitumen in various forms is found in the country bordering on the oil region of Alsace. Further explorations in this territory may lead to still more important discoveries, and the commercial importance of the inquiry is one guarantee that it will not be neglected.—*Engineer*.

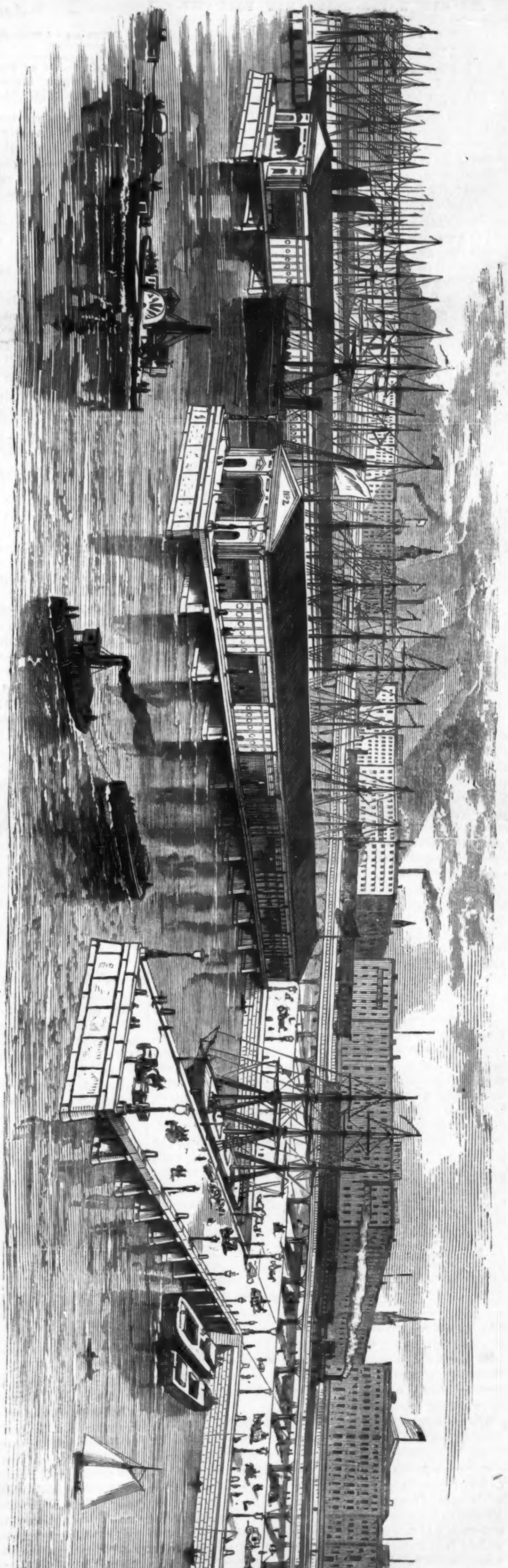
American Bismuth.

Bismuth is one of the rare metals, having many useful applications in the arts, which have been hitherto restricted to but few localities, principally in Saxony and Bohemia, in the Erzgebirge range of mountains. These mines have become so nearly exhausted that, even with no increase in the demand, a growing scarcity has been felt. It is said that discoveries of native bismuth have been made in Utah, in the town of Beaver, about two hundred miles south of Salt Lake City; and if the accounts which have been given of the existence of the ore are reliable, they are destined to attract no small share of attention. The deposit is said to be very extensive, and a well defined lode seven feet in thickness is reported to have been traced for a distance of more than twelve hundred feet. If these assertions be true, this discovery is a matter of great importance. The metallurgical treatment of the native bismuth is very simple. According to Makins, the ores are placed in tubular iron retorts arranged in a horizontal row, slightly inclined from the upper to the lower end. Heat is applied to the exterior of the retorts, when, in a few minutes, the metal begins to flow. A small rake is thrust into the end of the retort, and the heated ore stirred, which promotes a more rapid flow of the molten metal, which runs into iron dishes, where it is protected from the oxidizing influence of the air by a covering of powdered charcoal. In this manner a charge of a series of retorts, holding fifty-six pounds each, may be worked off in less than an hour. When no more metal runs off, the siliceous matrix is raked out of the upper end and allowed to drop into water, when the retorts are recharged and the operation continued.

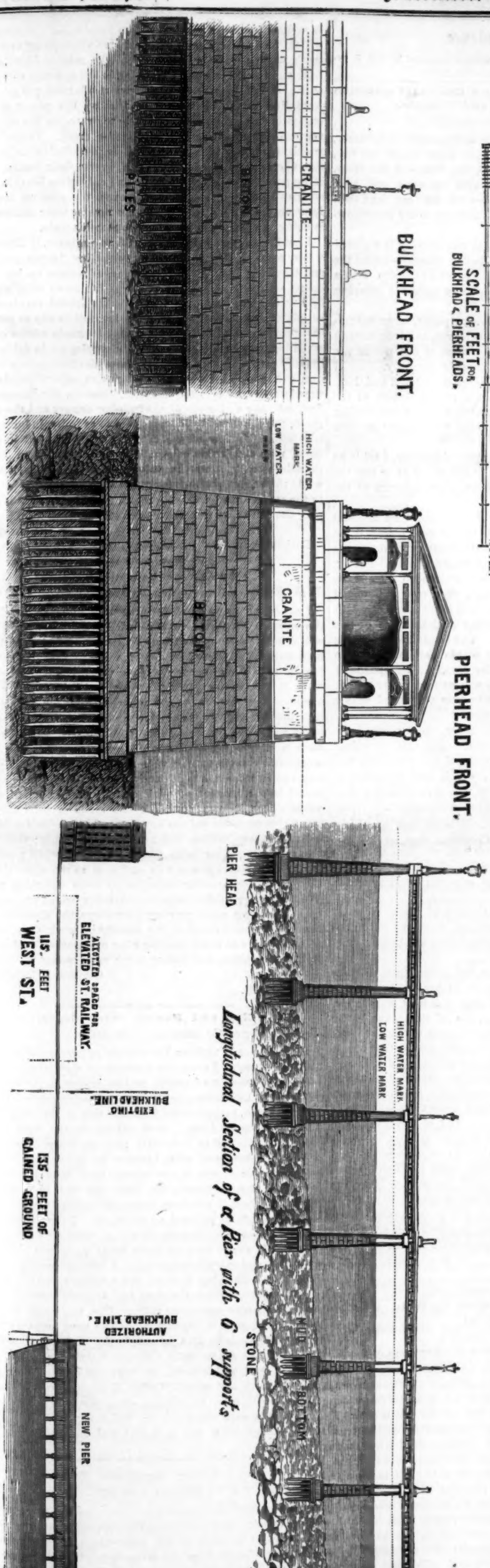
Boiler Explosions in Belgium.

M. Robert Vinçotte, a Belgian engineer, recently read a paper before the Liége Association of Engineers, in which he states that there are in Belgium about 11,000 steam boilers, and that there is an explosion of 1 out of every 1,274 boilers annually. In England there is annually 1 explosion out of every 2,000 boilers. In Belgium five out of every six explosions are due to the fact that the boilers have become too weak to resist the regulation pressure, and the sixth is attributable to the excess, over the proper pressure caused by the negligence of those in charge or the inefficient state of the safety apparatus or the gages.

A LIVE turtle, lately found on Long Island, had inscribed upon its shell "S. H. Rogers, 1801." It is therefore supposed to have lived more than three score years and ten.



NEW YORK CITY.—THE CONTEMPLATED IMPROVEMENTS ON THE RIVER FRONT—PERSPECTIVE VIEW SHOWING THE NEW SYSTEM OF PIERS AND BULKHEADS.



SKETCHES SHOWING THE FUTURE PIERS AND BULKHEADS.—[See next page].

THE NEW WATER FRONT, NEW YORK CITY.

[*See Engravings on page* 115.]

General McClellan has submitted his report upon the proposed new system of wharves and piers, and the Dock Commissioners have filed a demand with the City Comptroller for $1,500,000, wherewith to begin the work. With his own worldwide experience, and with the efficient aid of General A. A. Humphreys and General Q. A. Gilmore, he has elaborated a system of improvements which will place New York city very far in the lead of all other American ports, and on a par with the grandest and oldest port cities of Europe. General McClellan shows that our metropolis is unrivaled in its position as a great maritime and commercial mart, having far greater natural advantages than either London or Liverpool as a seaport. These latter ports both suffer from a contracted river front and from the great daily variations of the tide, while New York has a total available water front of 24½ miles. With these facts in view, he comes to the conclusion that the London system of enclosed docks—necessary there on account of the rapid and great tide variations—is not only unnecessary here, but would be expensive and pernicious. He therefore discards that system, and proposes a solid river wall, widening the river side avenue 200 feet on the East river and 250 on the Hudson, with piers of *béton* (artificial stone) or masonry projecting therefrom at the requisite distances from each other. Outlets at the pier heads will be made sufficient for sewerage purposes. In brief, the general system proposed is thus summed up by General McClellan himself:

First. To construct a permanent river wall of *béton* and masonry, or of masonry alone, so far outside of the existing bulkhead as to give a river street 250 feet wide along the North river, 200 feet wide on the East river, from the Battery to Thirty-first street, and 175 feet wide north of that point.

Second. To build piers projecting from the river wall of ample dimensions, adequate construction, and, so far as possible, affording an unobstructed passage for the water.

Third. Whenever it is necessary, to cover these piers with substantial sheds suitable to the requirements of each case.

As regards the expense, the report says that dock facilities equal to those in Liverpool can be obtained, under the arrangement proposed, at a cost incomparably less than that of those superb constructions. The General's conception includes an elevated railway, forming an *enceinte* around the river front. The possibility of such a road has long been regarded at once as one of the greatest advantages which a reconstructed wharfage system could offer, and one of the strongest reasons for undertaking it.

Commencing on both sides of the Battery, the first object is to increase the depth of water at the bulk heads. To effect this, as the work progresses, West street, fronting the North river, will be widened, by filling in and advancing the present line of bulk heads, until the street, from the warehouses to the shore line, has a width of 250 feet from the Battery to Eleventh street.

From the foot of West Eleventh street, going northward, the position of the channel will not permit of increasing the width of the river street until a short distance south of Twenty-third street, where the widening will again begin, and be continued to Fifty-ninth street, far enough, it is supposed, to provide for all the requirements of the commerce of the port for many years to come.

Along South street, fronting the East river, from the Battery to Gouverneur street, it will be 200 feet wide, thence, around Corlear's Hook to Grand street, 175 feet wide. Along this new shore line will be constructed a bulkhead of the general pattern shown in our artist's sketches. The soundings and surveys made by the engineer corps develop the fact that overlying the bed of the river the depth of mud varies from 8 feet near the Battery to 20 feet at pier 15, North river, and increases so rapidly that, in the vicinity of the gas houses, the depth is nearly 60 feet.

The engravings represent, in perspective, in elevation and profile, the alteration in the wharfage of New York. Our principal perspective view shows, in a telling manner, the extension of the piers into the water (represented at low tide in order to display as much as possible of the system) and the liberal boulevard gained to the city by the widening of the external avenue. The façade views of a pier and a bulkhead display the style of architecture contemplated. The profile of a pier exhibits the combined lightness and strength of the construction, and the free ingress and egress of the tide. A diagram displays, with the utmost effect, the ground gained by pushing out the wharfage to a more distant limit. The commencement of operations near the Battery will be anxiously looked for, and the progress of the work will meet with hearty coöperation from the mercantile community of New York, who see in this great plan of operations the one practical method of aiding to restore to this city its wandering merchant marine.

We are indebted to Frank Leslie's *Illustrated Newspaper* for the view and description of these important works.

CABMEN'S RESTS.—At Birmingham, England, the first of a series of movable waiting rooms for the use of cab drivers while waiting for hire has been presented by the Local Town Mission to the men on the rank near the Town Hall. The structure, which is of oval shape and mounted upon small wheels, is of stained wood and glass, and contains sitting accommodation for about a dozen men. It is furnished with a coke stove, at the door of which meat can be cooked in a Dutch oven, a boiler, and a locker for food. The current expenses of maintenance and cleaning will be defrayed by a small subscription among the men using the box.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

The Influence of Forests and General Vegetation upon Rain Falls and Climate.

To the Editor of the Scientific American:

Having for many years noticed in a dry season, in summer, where there was no dew on the open fields before sun rise, that, in entering a wood or a grove, the leaves of the trees, shrubs, and weeds were covered with moisture, and, also, that the thermometer ranged higher on the open land than it did amongst the trees, etc., I was induced to try the following experiments:

1. I took a small orange tree which was growing in a glazed flower pot—gave it two coats of shellac outside—sealed the hole at the bottom, and covered the earth on the top with a thin cake of putty, so as to prevent any moisture escaping therefrom.

2. I made a bell receiver with blotting paper, large enough to cover the tree without touching its leaves, and long enough to reach within two inches of the bottom of the pot on the outside, dried it by the fire and weighed it correctly.

3. I made another bell receiver larger than No. 2 and long enough to reach within half an inch of the bottom of the flower pot on the outside, and then placed it over the smaller one, No. 2. This one was well covered with shellac on both sides.

4. Before I sealed the top of the pot with putty, I set it on a tin roof in the sun from 6 A. M. to 6 P. M. so as to dry the earth in it and to exhaust the superfluous moisture of the tree itself.

5. I now recorded the weight correctly and then added 8 ounces of well water to the earth in the pot, placed it on a plate of glass, and set it on a table in my workshop; the hygrometer then indicated but little moisture in the building, as the wind was northwest. I then suspended over it the bell receiver of blotting paper; and, then over this one, I placed the shellac-covered receiver, and suspended both with a silk cord from the ceiling, leaving a clear space of two inches between the two receivers. The inside receiver came within two inches and the outside within half an inch from the bottom of the flower pot on the outside. I suspended a thermometer in the center of the orange tree under the receivers, and one of the same make was suspended with a silk cord from the ceiling of the room.

6. I kept them in this state 24 hours, then weighed the whole before I took off the receivers. The loss of weight was one dram avoirdupoise. I took off the receivers, and weighed the blotting paper one, which had increased in weight 6 drams avoirdupoise; there was no increased weight in the outside one which was coated with shellac. Water was condensed on the leaves of the orange tree, but I had no means of ascertaining its correct weight.

7. I dried the leaves of the tree, and weighed all again. The loss of water by the condensation of the leaves was 3½ drams avoirdupoise. This was as near as I could ascertain, without special apparatus.

8. The tree, itself, then, had taken up 9½ drams of water in 24 hours. None could have escaped from the soil in the pot, into the open air and the receivers, as it was hermetically sealed at both ends.

9. Those 9 drams of water, then, had passed from its roots through the tree, whose evaporation by heat had passed it into the atmosphere, to aid in forming rain falls, snows, etc.

Are not trees and forests then, one of the means, in the economy of Nature, to supply the air with moisture? The thermometer when first removed from the orange tree was at 68° Fah., the one suspended from the ceiling by a silk cord was at 71½° Fah., and the hygrometer indicated but little moisture in the room where the experiments were performed. According to these experiments, trees draw their water from the earth by means of their roots. And, if you investigate this subject strictly, you will find that in dry soils, the roots strike deeper in the earth than they do in swamps, so that they can obtain a sufficient supply of water for their growth and existence. I experimented with the spruce pine, the magnolia, the currant bush, and the sugar maple, all of which proved the truth of the conclusions I have mentioned above.

I hope some of my fellow citizens who are lovers of science will try these experiments on a larger scale for the benefit of all nations.

JAMES QUARTERMAN.

New York city.

When does an Engineer's Duty Cease in Case of a Collision?

To the Editor of the Scientific American:

In several of the late numbers of the SCIENTIFIC AMERICAN I have read articles upon the question "When does an engineer's duty cease in case of a collision?" On this subject, let me remind your readers of a law as to friction in stopping of a train by reversing the motion. It is this: If two surfaces slide upon each other, the friction will increase as the motion decreases, and decrease as the motion increases. That is, if two surfaces move upon each other at a slow rate the friction will be much greater than if they move at a rapid rate. Apply this law to stopping of a train of cars running at a high speed: When an engineer sees a train ahead of him, into which he must inevitably dash unless he brings his own to a stop, there are three things he does as rapidly as physical nature will permit: He whistles "down brakes," reverses his valve motion and pulls wide open his throttle. What is the result? If he will look at his drivers, he will see that they make but few revolutions in the direction in which the train is moving, but will immediately commence to turn in an opposite direction, at a high speed. Now it will take no great mathematician to calculate the speed which the driving wheels of his engine are slipping over the track when the train is moving at the rate of 30 miles an hour and the drive wheels spinning in the opposite direction at the rate of four or five hundred revolutions per minute. According to the above law in friction, the power of the engine is doing comparatively little to overcome the momentum of the train, even on a well sanded track. The point at which this power is in the greatest degree effectual is just as the wheels are about to slide or to reverse their motion, and if he partially closes the throttle and only gives his cylinders such an amount of steam as will exert the greatest reverse force on the driving wheels and not reverse their motion, he is doing the utmost in his power to stop his train.

I hold, then, that it is the duty of an engineer, if there are a few seconds of time left after whistling "down brakes" and throwing back his reverse lever, to remain on his footboard, watching closely the action of his drive wheels; and by keeping his hand on the throttle, he should regulate the supply of steam, as the drivers are inclined to slip or reverse their motion, until within two or three seconds of the crash, when his duty to humanity and his employers is fairly and bravely done, and it becomes him then to look to his own safety by abandoning his engine or otherwise. If the time is short, as is often the case, between the moment of first catching a glimpse of the coming danger and the final crash, there will be little or no time to exercise judgment in regulating the flow of steam to the cylinders; but in such cases, nine times out of ten, it would be better to let the throttle remain, after the valves are reversed, as it stood while the engine was being propelled on its forward course, as the steam thus supplied would do far more towards stopping the train than if flowing through a full throttle.

E. B. WHITMORE.

Rochester, N. Y.

Rubber or Leather Belts.

To the Editor of the Scientific American:

I notice, on page 48 of the present volume, an article on the relative merits of rubber and leather for belts. One would be led to suppose from this that the precise merits of both were to be fairly laid down, in which case it would be highly interesting to many of your readers; but on the contrary, it goes on to explain the many careless ways in which a rubber belt may be ruined in a short time, by running off into the gearing, by the lacing giving out, and in various other ways; and the writer forgets to state whether a leather band would be damaged under similar circumstances. He winds up by saying that a well made leather band, if properly looked after, the width and pulley surface being proportional to the amount of work done, will last 12, 15, or 20 years. Now, in comparing the two kinds of belts fairly, I think it is perfectly safe to say that rubber belts are better balanced than leather, and run more smoothly; they will also run in line after being used a long time, while a leather band will run first to one side and then to the other side of the pulley, owing to the soft spongy spots stretching most. We have large rubber belts made to order (which are endless, no lacing being used) running on pulleys, the diameter and face being proportional to the amount of work done, which do not require so much looking after as a leather band would in the same place, and costing much more money.

GEORGE B. DURKEE.

Chicago, Ill.

Clay and Fossils from Texas.

To the Editor of the Scientific American:

E. G. W. sends us from Texas some mineral specimens and fossils, and says: I send you a sample of clay from a bed we have here. Seeing an article on the subject in the SCIENTIFIC AMERICAN induces me to do so. The deposit is quite an extensive one, cropping out from the side of the bank where I took the sample from. It is subject to the wash of the tide; you will find in it a little salt, probably. I will also send you a sample of what I take to be the tusk or tooth of some monster. I dug it out of the bank near the clay. I measured the diameter; the large end was 10 inches, the small, 6 inches. It had been broken off at both ends, and was 8 feet long after I squared up the ends. Judging from the general appearance, it must have been upwards of 20 feet in length. I would like to know what the clay is, and what good for; and whether sample No. 2 is bone, or what it is.

Answer.—The clay is from the tertiary formation, extensively deposited along the Gulf and Atlantic borders. It is of no particular economic value. The fragments of fossil bone are of greater importance. You have probably found either the jaw bone of a whale or the tusk of an elephant. You will do well to make diligent search for more fossils, and you will undoubtedly be rewarded by the discovery of sharks' teeth and other remains of great scientific interest. If you will send us minute descriptions with drawings (lengthwise and sectional), we will aid you in identifying them. Look for a bed of lignite coal underneath the clay beds.—EDS.

The Young Machinist Replies.

To the Editor of the Scientific American:

On page 52 of your present volume, I find two answers to my "Young Machinist's Query." The first says that an engineer, to become a member of the brotherhood of locomotive engineers, "must be sober, truthful, moral, reliable, ever ready, and have good judgment." Let the man that has those qualifications serve from 3 to 7 years in any machine shop, instead of on the top of a cab, a wood pile, or the soft side of a hemlock plank (as our friend would have us believe he did), and you have a thorough engineer, one capable of taking

care of the "thousands of dollars worth of property and the precious lives entrusted to his care."

No. 2 says that he knows first class machinists who can build and repair an engine but cannot take charge as engineer. I hold that a man is surely wooden-headed who can build and repair an engine but cannot learn to run it. If the machinist is, as he says, only a first class laborer, I would like to know in what class he would put the man that does the work he has evidently been accustomed to, namely, pitching coal or wood into the furnace. So I say: Give me a man that can make his own calculations, in regard to the engine and boiler, and the use of steam, and who is a practical machinist, rather than a man who has served 20 years at pitching wood or coal into the furnace.

A YOUNG MACHINIST.

Galveston, Texas.

Ignition by the Rays of the Sun.

To the Editor of the Scientific American:

A singular case of fire occurred in this village a short time ago, which has caused considerable inquiry and discussion as to its cause; and as there are diverse opinions on the subject, we would be pleased to hear your views. On the 20th of last June, there was a piece of bituminous coal, containing about one cubic foot, lying on some dry pine board, against the south side of a wooden building, and out of the influence of stirring air, but where the rays of the sun shone fair upon it. At about 4 o'clock. P.M., the boards and side of the building close to this piece of coal suddenly burst into flames, and had it not been seen by a person standing near by, the building would have been burnt up; but as it was, the fire was extinguished with a few pails of water. The day had been cloudless and intensely hot, the thermometer ranging from 100° to 105° in the shade. The piece of coal had lain in the same situation for the last six months, and when water was thrown upon it to extinguish the fire, there was a hissing sound, as if just taken from a burning furnace. If this fire arose from the absorption of the rays of the sun, it becomes a matter of importance to avoid exposing solid blocks of coal in like situations.

H. W. S.

Millport, N. Y.

The Emma Suit.

The Emma Mining Company comes off conqueror in a suit instituted by it to restrain a rival company, whose workmen, last April, broke into the Emma works. This was the Cincinnati and Illinois Tunnel Company. When they made their appearance in the Emma, the workmen of the latter blocked up the opening, but shortly afterwards the "cave" in the Emma occurred, and cut the owners off from that part of their workings where their rivals had entered. When, after some delay, the fallen rock was penetrated, they found the Illinois men in possession of all that part of the Emma works, and the workmen of the latter mine were resisted in attempting to take possession of it.

The Illinois men claimed that the ground on which they stood did not belong to the Emma mine, but was separated from that vein by a clear space of about thirty feet, which was filled with barren rock. The present suit was then brought to decide the ownership of this part of the property. The Illinois men produced affidavits from some gentlemen who professed to be experts, and also from a number of discharged workmen, formerly in the employ of the Emma company. These gentlemen went into the mine and, peering around in places where the ore had been altogether removed, declared that they found no ore. Measuring the foot wall, they found it 30 feet wide at that spot, and assumed that for that distance there never had been any ore, and that the ground held by the Illinois people was accordingly separate and distinct from the real Emma vein.

On the other side, the owners of the Emma brought up men who had been constantly familiar with the mine during the time when that part of the ground was worked out, and who declared that ore had been taken out at every foot of the distance said to be barren. Assayers also went into the mine and, taking samples from spots at distances of two feet along the whole width of the so called barren space, found that all that rock carried silver, the lowest assay being more than $75 per tun. On this evidence Chief Justice McKean declared that the testimony failed to prove any disconnection between the ground acknowledged to be the Emma mine and that in dispute. He also gave expression to the opinion that the Emma company had a right to follow their ore outside of their own surface limits into neighboring ground, in accordance with the law which says that the patentee may follow the "vein or lode, with its dips, angles, and variations, to any depth, although it may enter the lands adjoining, which shall be sold subject to this condition."

This tunnel business, as we have before said, ought to be disposed of, once for all, by Act of Congress. If any man wishes to run a tunnel and can point to a definite body of ore which he expects to reach, he ought to have the right to that ore for the length of time it takes him to reach it by reasonable diligence. But how many of the tunnel claims in the Territories have been prosecuted with what, by any stretch of the imagination, can be called "reasonable diligence?" Not one in a hundred. Whoever examines that country finds, in every district, tunnel "stakes," marking locations that have never had a pick struck into them, or else have been seriously neglected. This style of mining has not borne fruits sufficient to entitle it to the protection it enjoys. It is extremely hazardous to the other, which we may call, in contradistinction, the *straightforward* style of work. We can but feel pleasure at the victory of the Emma company in this case. Whatever criticism that concern is open to on other points, it at least deserves the credit of having worked its property with fair diligence. This is the only return the American people ask for the free gift of their mining property, and to this they are certainly entitled.—*Engineering and Mining Journal.*

Gravitation, Light and Heat.

The law of gravitation enunciated by Newton is that every particle of matter in the universe attracts every other particle with a force which diminishes as the square of the distance increases. Thus the sun and the earth mutually pull each other; thus the earth and the moon are kept in company; the force which holds every respective pair of masses together being the integrated force of their component parts. Under the operation of this force, a stone falls to the ground and is warmed by the shock; under its operation, meteors plunge into our atmosphere and rise to incandescence. Showers of such doubtless fall incessantly upon the sun. Acted on by this force, were it stopped in its orbit tomorrow, the earth would rush towards and finally combine with the sun. Heat would also be developed by this collision, and Mayer, Helmholtz, and Thomson have calculated its amount. It would equal that produced by the combustion of more than 5,000 worlds of solid coal, all this heat being generated at the instant of collision. In the attraction of gravity, therefore, acting upon non-luminous matter, we have a source of heat more powerful than could be derived from any terrestrial combustion. And were the matter of the universe cast in cold detached fragments into space, and there abandoned to the mutual gravitation of its own parts, the collision of the fragments would in the end produce the fires of the stars.

The action of gravity upon matter originally cold may in fact be the origin of *all* light and heat, and the proximate source of such other powers as are generated by light and heat. But we have now to inquire what is the light and what is the heat thus produced? This question has already been answered in a general way. Both light and heat are modes of motion. Two planets clash and come to rest; their motion, considered as masses, is destroyed, but it is really continued as a motion of their ultimate particles. It is this motion, taken up by the ether, and propagated through it with a velocity of 185,000 miles a second, that comes to us as the light and heat of suns and stars. The atoms of a hot body swing with inconceivable rapidity, but this power of vibration necessarily implies the operation of forces between the atoms themselves. It reveals to us that while they are held together by one force, they are kept asunder by another, their position at any moment depending on the equilibrium of attraction and repulsion. The atoms are virtually connected by elastic springs which oppose at the same time their approach and their retreat, but which tolerate the vibration called heat. When two bodies drawn together by the force of gravity strike each other, the intensity of the ultimate vibration, or, in other words, the amount of heat generated, is proportionable to the *vis viva* destroyed by the collision. The molecular motion once set up is instantly shared with the ether, and diffused by it throughout space.

We on the earth's surface live night and day in the midst of ethereal commotion. The medium is never still; the cloud canopy above us may be thick enough to shut out the light of the stars, but this canopy is itself a warm body, which radiates motion through ether. The earth also is warm, and sends its heat pulses incessantly forth. It is the waste of its molecular motion in space that chills the earth upon a clear night; it is the return of its motion from the clouds which prevents the earth's temperature on a cloudy night from falling so low. To the conception of space being filled, we must, therefore, add the conception of its being in a state of incessant tremor. The sources of vibration are the ponderable masses of the universe. Let us take a sample of these and examine it in detail. When we look to our planet we find it to be an aggregate of solids, liquids, and gases. When we look at any one of these, we generally find it composed of still more elementary parts. We learn, for example, that the water of our rivers is formed by the union, in definite proportions of two gases, oxygen and hydrogen. We know how to bring these constituents together, and to cause them to form water: we also know how to analyse the water, and recover from it its two constituents. So, likewise, as regards the solid portions of the earth. Our chalk hills, for example, are formed by a combination of carbon, oxygen and calcium. These are elements, the union of which, in definite proportions, has resulted in the formation of chalk. The flints within the chalk we know to be a compound of oxygen and sil cium, called silica; and our ordinary clay is, for the most part, formed by the union of silicium, oxygen, and the well known light metal, aluminium. By far the greater portion of the earth's crust is compounded of the elementary substances mentioned in these few lines.—*Tyndall.*

How to Kill Weeds.

By attending the following directions, weeds may be completely extirpated:

1. Study their habits. Without this, you are working in the dark. You are shooting without taking aim, and are more likely to miss than to hit.

2. Have faith that weeds can be killed.

3. Should you, for the first year or two, see little benefit from your labor, do not relax your efforts. You will certainly triumph in the end. This is the experience of all gardeners; and a firm conviction of this truth is one of the strongest incentives to perseverance.

4. Be forehanded with your work. This is exceedingly important. It is so not merely because weed plants can be killed easily just as they begin to grow, but it often happens that many weeds actually go to seed before they get large enough to attract attention. Chickweed (*stellaria*) is quite a pest in many gardens. We have known much labor and time spent, year after year, in efforts to keep this little plant in check, but all in vain, because the work was not commenced early enough in the spring and continued late enough in the autumn. The plant will flower in the snow, and tens of thousands of seeds were matured before the ground was cultivated in the spring. The garden was forked over and hoed repeatedly during the summer, and every weed raked off (after they had gone to seed), but during the wet weather, thousands of little plants would spring up, but were not thought to be injurious, and were suffered to remain to grow all winter and seed the land again early in the spring. The gardener declared it was impossible to get rid of chickweed. And so it is with many other weeds. We could get rid of them if our labor was directed by a little correct knowledge of the habits of the plants, and was applied at the right time. Many think it impossible to free the land of couch or quick grass (*triticum repens*), and their experience seems to them to justify the opinion. But it will be found that they are not forehanded in their work. They apply labor enough, but it is too late. They let the plants grow until the ground is covered with the leaves of the couch, and then they hoe and rake and cultivate, and may be fork out as many roots as possible. But they cannot get out the whole. The roots are broken into small pieces, and each piece produces a new plant, which soon pushes out its roots in all directions in the loose and mellow soil Had the work been commenced before the couch plants pushed out their leaves, and been kept up so vigorously and continuously that the young shoots could not get to the surface, and the soil constantly cultivated during the hot dry summer months, every couch plant would be destroyed. We have tried the plan, and know that couch can be effectually got rid of in this way. But no half way measures will succeed with it.

5. Burn all the thistle heads and other weeds that are cleaned out of the garden. Many seem to think the best place to put these weeds is in the roads. The man that does it should be indicted for a nuisance. He forgets that these weed seeds will stick to the feet of horses and other animals. Another plan is to feed these seeds to the fowls. All that are not digested will grow. If there is so much grain among the weed seeds that you do not like to burn them, boil before feeding.

6. Look to the manure. This is a fruitful source of weeds. If the crops are foul, the manure will certainly be full of weed seeds. Fermenting the manure will not kill these seeds unless the seeds themselves are decomposed, which is seldom the case. The better plan is to pile the manure, turn it, and get it thoroughly rotted, and then apply as a top dressing.—*London Farmer.*

Glacial Phenomena in the vicinity of New York.

The evidences of a glacier once moving over the island of New York are of three classes: 1st. The grooves, or striæ, and other results of the abrasion of the rocks of the island, wherever they are visible. 2d. The mantle of drift which partially conceals the rocks. 3d. Facts observed over the hills of the neighboring island of Long Island. All the evidences of the first class show that the movement and agencies causing them proceeded from the northwest towards the southeast. Following this northwest direction from this island over the highland range of "Archæan" rocks at the Ramapo Gap, N. Y., we find the same general evidence that we do elsewhere eastward. The same evidences can be seen in the Pompton Gap, Dover, and at Lake Hopatcong, N. J.

Some years ago I traversed the hights from this lake to West Point on the Hudson, and everywhere the evidence of some agent moving southeastward over them, rounding their summits, tossing them on their western slopes, was always present before me. The sum of all this evidence confirms Professor Dana's theory of a glacial plateau on the highlands of Canada.

The second class of evidence—the material composing the mantle of drift—always shows it to have been transported from the northwest. Both on this island and Long Island the material is from rocks known to lie to the northwestward. Thus on the island we find boulders and huge masses of the serpentine and trap rocks of New Jersey blended with the red sand rock of the same State. In Brooklyn, on Long Island, we find, in addition to the rocks of New Jersey, those from New York island blended with the others. I have seen huge masses of anthophylite in Atlantic street, Brooklyn, which must have come from the parent bed of this rock, on Tenth avenue and from West Fiftieth to West Sixtieth street, New York. Careful measurement of the direction of the movement which must have transported these rocks shows it to have been from N. 10° W. to S. 10° E. This course tallies with measurements made on the palisades by Professor Cooke. The agency which threw this mantle over the island had power to take up and transport immense masses of red sandstone from New Jersey to New York and Long Island. Many blocks in the city, as at East Seventy-third, East Seventy fourth, East Seventy-fifth, and East Seventy-sixth streets, Third avenue, New York, lying beneath the surface soil, are four, six, and eight feet thick, giving in the excavations an appearance of being independent red deposits in the drift.

The third class of evidence is the immense drift deposits on Long Island. These stretch from Oyster Bay, S. 60° W. to Fort Hamilton, and over to Staten Island. Was not this ridge a terminal moraine? Through this moraine the Hudson river breaks at the Narrows at almost right angles to the trend of the Hudson valley.—*R. P. Stevens, M.D., American Journal of Science and Arts.*

THE annual State exhibition of the Kansas Board of Agriculture will take place at Topeka Sept. 16th.

FIRELESS LOCOMOTIVE.

Dr. Emile Lamm, of New Orleans, whose invention of the ammonia engine was described and illustrated at page 290, Vol. XXV., of the SCIENTIFIC AMERICAN, has lately been giving his attention, with very successful results, to the economic and absolutely safe propulsion of street cars by steam power.

He was satisfied from the collected experiments of the past century that the efficiency of steam, together with its intrinsic cheapness, could not be called in question. The objections to its use lay, first, in the constant danger attending its generation in a boiler placed over an active fire; and, second, in the consequent expense incurred when such a boiler is used with a small engine doing but little work; for the ever present danger has to be guarded against with a care equal to that required for a much larger apparatus, and a skilled attendant must therefore be employed at a very disproportionately high price. From this he concluded that if the danger attending the ordinary steam engine could be avoided entirely, a skillful attendant would not be needed to drive it, and the problem of working steam cheaply on a small scale would be near solution.

These conclusions led him to the invention of the "thermo-specific" or fireless locomotive, which forms the subject of the present article, and which is illustrated in the annexed engraving.

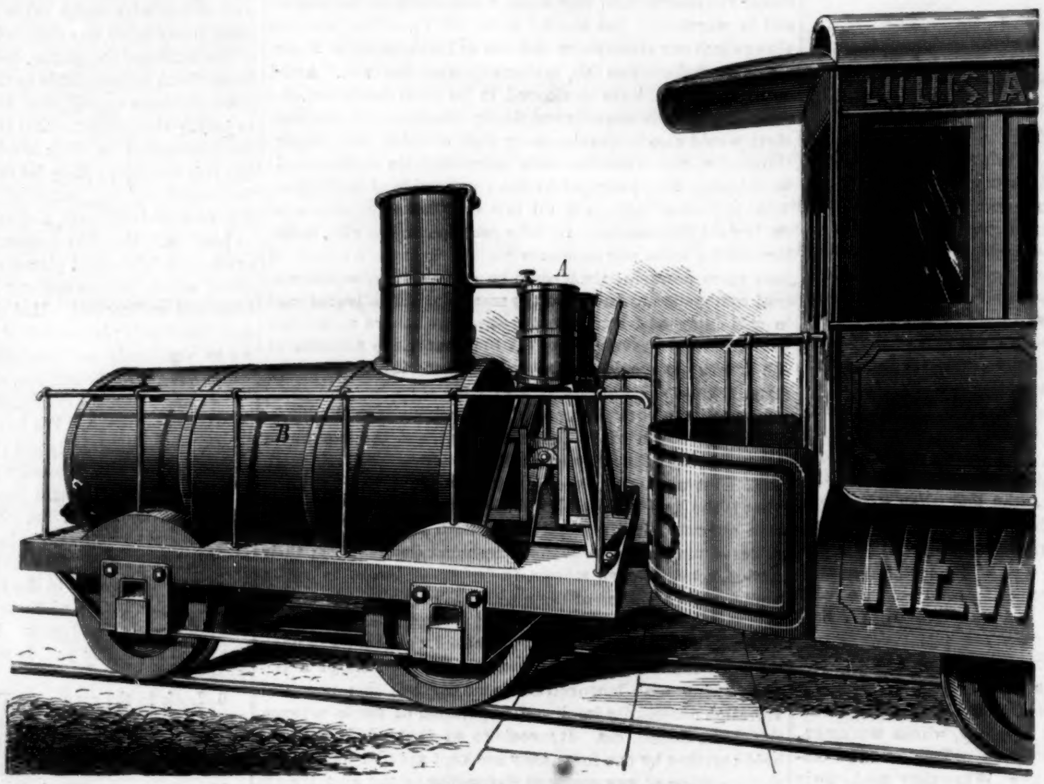
The driving engine, shown at A, is a steam engine of ordinary character, and does not require explanation. B is simply a reservoir large enough to contain about 300 gallons of water and leave steam room above it. It is made of steel, and is well covered with non-conducting material so as to prevent the radiation of heat. Inside, from end to end, near its bottom, runs a pipe which is perforated with numerous small holes in its periphery, and which is connected with a universal coupling attached to the front of the reservoir. It is also provided with a water cock, etc., steam drum, and proper steam connections with the engine. The operation of the apparatus is as follows: By making suitable connections with a stationary steam boiler, it is first heated throughout, and then a sufficient supply of water of the requisite temperature is forced into the reservoir. When properly charged, the water is flush with the water cock, and its temperature is about 380° Fah., the pressure in the reservoir being about 170 lbs. to the square inch. The locomotive is then ready to be started on its trip, there being sufficient power stored up in the reservoir to enable it to run the attached car a distance of nine miles without expending the whole of it. Before beginning the next trip, the charge is renewed by again coupling the reservoir with the stationary boiler, from which steam is forced in for about four minutes through the perforated pipe; by which operation the temperature and pressure are restored, and the water which went off in the form of steam during the previous performance of the engine is replaced.

The rationale of the foregoing need not be dwelt upon. Suffice it to say that, in obedience to well known laws, as the pressure within the reservoir is relieved by the passage of the steam into the engine, a portion of the water in the former is converted into steam by the heat with which it is surcharged. This conversion would go on until the temperature in the remaining water had fallen to 212°. It is calculated that with the reservoirs as now used, about fifty gallons of water is converted into steam before this point is reached. The steam given off develops sufficient power to make a nine mile trip easily, and leaves a pressure of 60 lbs. in the reservoir at its completion.

The absence of danger of explosion in using this apparatus is apparent, and it is real, also. The pressure in the reservoir can never rise above the point reached at the time it is charged; and after that, it is necessarily continually diminishing as the power is expended. It requires even less skill to drive this locomotive than it does to drive a horse or mule car, and the economy sought in this direction appears to be fully attained. Our space will not allow us to go into the details of the advantages and general economy claimed for this system of propulsion over the regular horse railroad system. General G. T. Beauregard, who is president of the New Orleans and Carrollton Railroad Company, on whose road Dr. Lamm's fireless locomotive has been running, and who have just adopted his invention, has made a comparison between the relative expenses of the two systems, and finds a difference of 33⅓ per cent in favor of the new over the old.

The calculations for the new system were based on fifteen locomotives supplied by one set of stationary boilers. One particular advantage claimed by the inventor, who has already made over a thousand trips of six miles each with his locomotive, is the latitude allowable in its construction and application by reason of the absence of the furnace.

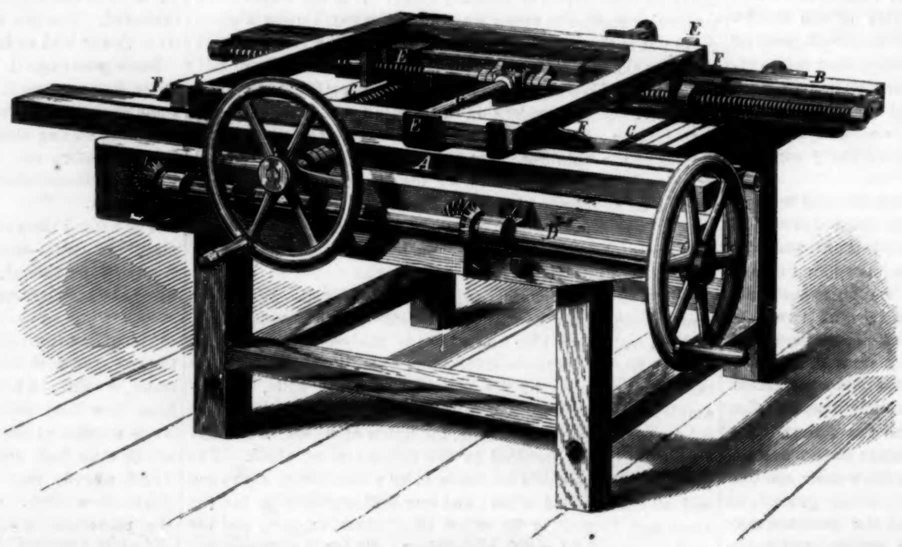
Patented April 9, 1872. Further information may be obtained of The Ammonia and Thermo-Specific Propelling Company of America, 175 Common street, New Orleans, or by addressing the inventor, P. O. Box 1,493, in that city.



LAMM'S FIRELESS LOCOMOTIVE.

SASH COUPLING MACHINE.

The improved sash clamp represented in our engraving is the invention of Mr. James H. Phillips, of Troy, N. Y., and was patented by him through the Scientific American Patent Agency, June 18, 1872. Its construction we proceed to describe:



PHILLIPS' SASH COUPLING MACHINE.

Upon a suitable frame, such for instance as depicted, are mounted two head blocks; one of which, A, is stationary, and the other, B, is movable toward or from the first, on the grooved ways shown on the top of the frame. These movements are produced by operating the two screws, C, which are geared to the hand crank shaft, D. The head blocks are provided with adjustable metal clamping pieces, E, upon which is laid, in the manner indicated in our illustration, the sash or other frame which it is intended to square up and press together. The peculiar form of these clamping pieces will be understood by inspecting those seen on B; they conform to the rectangular figure of the head block on three sides, and on the fourth are turned up perpendicularly so as to clamp the frame perfectly square. By properly arranging the clamps, E, the terms of the side pieces of the sash frame are left room to project beyond the mortises in the end pieces through which they are driven, on being compressed by the machine.

The clamps by which the sides of the frame are held shown at F, are mounted on ways in the head blocks and are operated by two pairs of twin right and left hand screws which are fitted to them. One of the pairs of screws runs in bearings attached to the head block, A, and the other in bearings connected with the movable block, B, the latter pair being so distinctly shown in the engraving that no further explanation is needed. Both pairs are geared to the crank shaft, G, so as to be actuated simultaneously by its rotation, and the middle wheel of the gearing next B is arranged so as to slide with the block along the shaft, G.

When the clamps, E, are suitably adjusted, the machine is made to conform to any size and shape of frame, within its limits, by simply working the hand cranks, and the squaring and compressing of the frame is performed by it with ease and certainty.

In order to allow the frames to be bored and pinned while yet clamped in the machine, the upper sides of the head blocks are made with longitudinal grooves, as represented, of sufficient depth and width to allow the boring tool to work clear through the frame to afford clearance for the chips and room for the pin to project when driven. In securing the joints of doors, which is commonly done by splitting the tenons and driving in wedges, ample access is given to them between the clamps, E, and the wedges can be driven while the door is clamped.

The machine has received practical trial, and is claimed to be much superior to others hitherto used in sash finishing, saving both time and labor; a boy may operate it effectively.

The inventor, who wishes to dispose of a part or the whole of his rights, may be communicated with at 116 Congress street, Troy, N. Y.

Vibration of Glasses Cracked or Containing Effervescing Liquids.

It is known that a glass containing effervescing liquid will not give a clear note when struck, and that as the effervescence subsides the tone becomes more and more clear. When the liquid is perfectly tranquil, the glass will ring as usual, but on re exciting the effervescence, the musical, tone again disappears.

The phenomena presents itself to my mind as being due to a certain amount of vibration communicated to the glass by the agitation arising from the effervescence. This vibration—which can be easily heard by placing the ear close to the glass—interferes with that caused by striking the glass, and destroys more or less the proper rhythmic movement necessary to the production of a musical note, according as the intensity of the agitation of effervescence is greater or less.

The dead sound of a cracked glass is probably owing to a similar cause. For in that case, as soon as the vibrations traveling round the glass arrive at the crack, the edges of which are wholly or partially in contact, they are transmitted from edge to edge; and as, owing to the friction of the edges one against the other, their vibrations do not synchronize, a reflex wave is impinged upon each, having a less velocity than the original wave. This reflex wave will correspond to the vibration caused by effervescence. If the crack be cleanly cut out, so as to separate the edge by a well defined interval, the glass will again emit a musical note. In the latter case, the sonorous vibrations, on arriving at the cut portion, return by the way they came, synchronizing with those which they meet.

The dead sound of the glass, when filled with honey or treacle, is probably owing to the circumstance of these fluids being not sufficiently mobile to vibrate in unison with the glass; and thus they destroy its musical tone as effectually as if they generated an independent and non-synchronous vibration.—*Allen Beazeley, in Nature.*

THE SEWAGE OF PARIS.—The question as to the treatment of the sewage of Paris has been settled, by its concession for fifteen years to the London Peat Engineering and Sewage Filtration Company. For a long time the sewage has been dealt with by the Le Sage company in the most primitive manner—namely, by spreading the solid matter upon the ground to dry, causing fearful annoyance for miles around, and provoking general outcry against the barbarous practice.

Scientific American.

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Contents:

(Illustrated articles are marked with an asterisk.)

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

This body of the prominent scientific men of the United States commences (as noticed elsewhere) this year's meetings on August 22d, at Dubuque, Iowa. It was at first intended to meet in San Francisco, if found practicable by the committee in charge of selecting the place of meeting: but such urgent invitations were received from Dubuque that the latter place was chosen. By the hospitality of the citizens, all the members will be privately entertained, and arrangements have been made for free excursions to different places of scientific interest in the neighborhood, so that this meeting promises to be as satisfactory to all concerned as any previously held elsewhere.

Perhaps no association is so little understood by the public and even by the press as this; and this is the reason that, after every meeting, most absurd criticisms are indulged in by the reporters. People complain that the subjects discussed are not popular enough to be understood by the visitors who may drop in; but it ought not to be lost sight of that this association was by no means founded for the popular diffusion of knowledge. The latter object would require permanent courses of elementary lectures, in place of the meeting of some two hundred of the prominent scientists of this continent in a single city for only one week in a whole year. If the people anywhere feel the want of popular and continuous diffusion of knowledge, they ought to found, in the different cities and towns, local institutions, where, by means of lectures and experiments, given free to all by competent lecturers, the public may receive the needed scientific information. Such institutions would without doubt have the good wishes of all the members of the American Association for the Advancement of Science; but they would labor in an entirely different field, the diffusion of information obtained, while the said association labors, like the Smithsonian Institute in Washington, for the increase of our stock of scientific knowledge. This diffusion, or the instruction of the people, or teaching in general, is a field of labor entirely foreign to the purposes of the association, notwithstanding that most of its members are publicly or privately engaged therein, as their regular occupation.

That the meetings are held with open doors is not with the expectation that ignorant people, who happen to drop in, will learn anything or be pleasantly entertained, as many appear to expect; but simply because science has no secrets. Uninstructed visitors have about as much right to expect to obtain information or amusement when dropping in upon a Congressional session in Washington. The members of the association can think as little about entertaining occasional visitors as the members of Congress. In both sessions are duties to be performed, regardless of audience or visitors, namely, bringing facts and honest opinions before the body of the house, which in one case is political, in the other, scientific.

Certain subjects treated are uninteresting not only for the public, they are so even to those members who have not made a study of them. Therefore the meetings are divided into sections, so that, in section A, Mathematics, Astronomy, Physics and Chemistry are discussed, in section B, Geology and Natural History, in section D, Microscopy. This is also done in order to save time, as otherwise the time occupied by the meeting would be protracted to four weeks in place of one. The objection, however, is that it frequently happens that such interesting subjects are discussed in several sections that often members regret their inability to attend more than one section at the same time.

Upon the surface, however, the great benefits of these meetings do not appear. One is the profit, to men engaged in a common pursuit and who love that pursuit, of being brought together for private conversation, discussion, and interchange of opinions. The discussions arising after the reading of a paper are often the most important part of the proceedings, and it is to be lamented that no note is kept of these, except by newspaper reporters, from whom of course, it cannot be expected that they will be able to distinguish matter of genuine value from the chaff which occasionally runs among it.

The wisdom of keeping up the migratory character of these meetings has been doubted. There are two reasons: One is that no city should claim preëminence as a scientific center, as this would make the association less national by existing local jealousies, and science must try to be eminently cosmopolitan. Another reason is that, in the city where the meeting is held, the representatives of science in the United States will stimulate a love for scientific research, and this has been, thus far, actually the case in almost all places where the meetings have been held.

A very striking feature in the character of the discussions is the peace and harmony which pervades all from beginning to end. There may be different opinions in regard to the explanations of observed facts, but there is constantly a tendency to unification as the erroneous opinions are constantly being given up, when truth prevails and all agree in the end. Compare this with meetings where prominent men of different schools of politics or religion are brought together; would they discuss for a whole week the subjects of their devotion, and separate with such perfect good feeling, and leave behind them in the place where they met, so favorable an impression as is the case with the men of science?

CANADIAN PATENTS.

We again remind our readers that the new patent law of Canada goes into effect on the 1st of September, on and after which date all citizens of the United States may take patents in the Dominion without let or hindrance.

Patents will be granted in Canada for periods of five, ten, and fifteen years. The two first periods may, before their expiration, be enlarged to fifteen years, on simply filing a petition for an extension and paying a small fee.

A model is also required, and on this subject the rule established by the Canadian Commissioner of Patents is as follows:

Rule 7. Models must be neat and substantial ones, not to exceed eighteen inches on the longest side, unless otherwise allowed by special permission; such models must be so constructed as to show exactly every part of the invention and its mode of working. In cases where samples of ingredients are required by law, they must be contained in glass bottles properly arranged; but dangerous or explosive substances are not to be sent. Both models and bottles must bear the name of the inventor, the title of the invention, and the date of the application; and must be furnished to the Patent Office free of charge and in good order.

It will be observed that the foregoing rule only requires that every part of *the invention*, and its mode of working, shall be exhibited in the model. If the invention consists of an improvement upon some part of a known machine, it will not be necessary to make a model of the whole machine, but only those parts that are needed to show the intended working of the improvement. For example, if the invention relates to vehicles, and consists in an improvement in the construction of the wheel and axle, it will not be necessary for the inventor to furnish a complete model of a vehicle, but only a model of a wheel and axle, made according to the improvement. This is also the rule at our United States Patent Office.

For the information of those who contemplate taking out Canadian patents, Messrs. Munn & Co. have prepared a circular containing full directions, copies of which can be had free of charge by simply addressing them at the SCIENTIFIC AMERICAN Office. The Dominion of Canada is a splendid field for the introduction of new inventions. Her population is 5,000,000, and rapidly increasing. Her people partake of the spirit of enterprise which governs here. The Canadians are now building a railway from the Atlantic to the Pacific, and everything indicates a spirit of progressive activity.

THE AURORA.

On the evening of the 3d instant, occurred one of the most magnificent auroral displays that have ever been witnessed in these latitudes. Many of the principal phases of the phenomenon, previously noticed by observers at the polar regions, were here brilliantly produced, the convoluted curtain clouds excepted.

The display began with the formation, at the northern horizon, of the bright arching bank or auroral bow, having a greenish yellow tint which illuminated the earth as if the full moon were shining. Pencils, brushes, columns and streamers of light, of various shades and fantastic forms, shot upwards with amazing rapidity to the zenith, where they converged, forming a remarkable nucleus or crown of glory. The eastern portion of the columns and streamers now glowed with transparent crimson colors; and then began a general upward undulating, waving, flickering and radiating movement of the luminosity, of indescribable beauty. The most remarkable part of the display lasted for about fifteen minutes, when its force appeared to have been somewhat spent; but some two hours elapsed before the aurora had wholly disappeared.

The Utica (N. Y.) *Herald* says: "The skies over Utica and other equally favored places presented a peculiar and most beautiful appearance. Directly overhead, a central whirl of fire, assuming different forms and tinted at times with red or purple, was surrounded by straight shoots and sheets of pale flame, constantly varying and shifting, which reached from the zenith to the horizon, except in the extreme south. At one time the form of an angel with outstretched arms and spread wings could be plainly traced in the flaming center of this grand display."

The precise origin of the aurora borealis, how and why it makes its appearance, is not fully understood, and still forms an interesting subject for investigation among the students of science. Many theories have been put forth, some of which we will briefly mention, together with a few facts.

A number of intelligent observers, stationed in polar regions such as Greenland and Iceland, aver that the aurora is sometimes accompanied by hissing and crackling sounds, the latter resembling electrical sparks. The Esquimaux natives also say that these sounds are very often heard in connection with the lights. But Kane, Richardson, Parry, and other arctic travellers were unable to detect any sounds, while Wentzel attributed the noise to the contraction of the snow from sudden increase of the cold.

The hight of the aurora is differently estimated by various observers, ranging from one mile to five hundred miles from the earth. Some of the best observations bring the light within the limits of the clouds, and indicate that the auroral pencils may even be swayed by the winds and currents of air. It is believed that the auroral light has a considerable thickness or body. It is visible at immense distances. The same aurora has been seen at the same time in Europe, Asia, and North America, on a parallel as low as Cuba and Spain.

Professor Olmsted has attributed the aurora to the sudden plunging of the earth into what might be termed a cosmical atmosphere or vapor, composed of atoms of nebulous matter, the light being produced by the friction of this matter against the earth's atmosphere. This coincides with Biot's theory, who was of opinion that the atoms were composed of iron and served as conductors between various atmospheric beds, unequally charged with electricity; when the tendency of the electricity to get into equilibrium surpasses the resistance of the imperfect conductive powers of the atoms, an electrical discharge ensues, and the nebulous molecules sparkle, thus producing the aurora. This curious theory is altogether surpassed by that of the editor of the New York *Herald*, who, in commenting upon the recent aurora says: "The most satisfactory explanation of these splendors in the northern skies seems to be that which connects them with the reflection of electric discharges from the microscopic ice crystals, which compose the delicate cirrus clouds in the upper atmosphere. These crystals of condensed vapor, so minute as to defy any but the most practiced observer, act as a screen for the reflection of light; and the deposition of watery vapor from the lofty equatorial current produces the lightning discharge."

In a previous number of the same newspaper, the phenomenon is explained as follows:—"The origin of the aurora borealis is simply this, speaking sensibly:—It is caused by the refraction of the rays of the sun upon the vast fields of ice which line and fill up the shores of Labrador, Behring Straits and the Hudson Bay Territory."

Leaving these amusing, not to say absurd, theories, it may be remarked that magnetism and electricity are in some way connected with the auroral development. The auroral lights, pencils, and streams may be artificially produced by means of a glass tube containing rarefied atmospheric air through which electricity from a machine is passed, or in which tube it is excited by friction. A description of the tubes was recently published in the SCIENTIFIC AMERICAN.

Another device for the artificial production of lights which appear to be analogous to the aurora consists of an iron bar, enclosed within a rarefied air chamber. Luminosity, of different kinds, is here produced at will, either by the electrical machine, or by the contact of the iron bar with one of the poles of an electro-magnet.

De la Rive says that luminous effects similar to those of the aurora may be obtained if a continuous current of ordinary electricity is made to arrive at the pole of a powerful electro-magnet in moist, rarefied air.

The magnetic needle is almost always deflected and agitated during the continuance of the auroral display.

During the aurora, the telegraph wires often become charged with electricity which in its nature appears to resemble galvanic electricity. Mr. Culley, the distinguished English telegraph engineer, stated that the aurora was a kind of lightning, differing from ordinary lightning in being a gentle and gradual flow, instead of a violent and sudden discharge. Telegraph wires that run east and west are said to be most affected during the aurora. Humboldt regarded the aurora as an electric activity which manifested itself by the fluctuation of the magnetic needle and by the appearance of the auroral light. Faraday suggested that the aurora was connected with currents of electricity induced by the earth's rotation and urged towards the poles, whence it is endeavoring to return, by natural and appointed means, above the earth to the equatorial regions. The results of experiments indicated by him confirm the correctness of this suggestion.

Dr. Nichol says: "It is vain to search at present for a theory of the aurora. What is known is this: The direction of the auroral *jets* or *rays* and the position of the *crown* have a connection with the magnetic meridian; and the aurora produces great magnetic perturbation."

Professor Loomis gives the following particulars:—Auroral exhibitions take place in the upper regions of the atmosphere, since they partake of the earth's rotation. All the celestial bodies have an apparent motion from east to west, arising from the rotation of the earth; but bodies belonging to the earth, including the atmosphere and the clouds which float in it, partake of the earth's rotation, so that their relative position is not affected by it. The same is true of auroral exhibitions. Whenever an auroral corona is formed, it maintains sensibly the same position in the heavens during the whole period of its continuance, although the stars meanwhile revolve at the rate of 15° per hour.

The grosser part of the earth's atmosphere is limited to a moderate distance from the earth. At the hight of a little over four miles, the density of the air is only one half what it is at the earth's surface. At the hight of 50 miles the atmosphere is well-nigh inappreciable in its effect upon twilight.

The phenomena of lunar eclipses indicate an appreciable atmosphere at the hight of 66 miles. The phenomena of shooting stars indicate an atmosphere at the hight of 200 or 300 miles, while the aurora indicates that the atmosphere does not entirely cease at the hight of 500 miles. Auroral exhibitions take place, therefore, in an atmosphere of extreme rarity; so rare indeed that if, in experiments with an air pump, we could exhaust the air as completely, we should say that we had obtained a perfect vacuum.

The auroral beams are simply spaces which are illumined by the flow of electricity through the upper regions of the atmosphere. During the auroras of 1859, these beams were nearly 500 miles in length, and their lower extremities were elevated about 45 miles above the earth's surface. Their tops inclined toward the south, about 17° in the neighborhood of New York, this being the position which the dipping needle there assumes.

COUNTRY CHURCHYARDS.

An English journal of recent date complains of the uninviting and desolate appearance so common in the plots, set apart in villages and towns, for the interment of the dead. If the remarks made by our contemporary are applicable to the rural churchyards of England, where every hamlet, from its very age, supplies the elements of the picturesque, they are doubly true in reference to the barren and forbidding enclosures found in the newly built villages which abound in our own country.

We do not of course refer to those magnificent cities of the dead which adjoin our great towns, for on these every resource of art and skill has been unsparingly lavished; but to the simple acre or two of land, which either surrounds the rural church or else is fenced off, solitary and alone, on the outskirts of the populated quarter. Every one is familiar with its appearance; bleak, bare and desolate, totally devoid of ornamentation, the surface of the ground broken and irregular with heaped up mounds of earth, and covered with headstones and monuments standing stiff and white, like ghosts, over the graves. If trees there be, they are generally clumps of pines, lugubrious and solemn in their dark shades. The grass is long, and coarse, rank weeds abound, while the few flowers that bloom here and there are wild and uncultivated. Perhaps a few plots within the enclosure, the family burial places of the magnates of the village, are surrounded with cheap iron railings which, while adding to the prim formality of the spot, convey the impression that its occupants maintain their exclusiveness even in the tomb.

It is a beautiful idea, taught us by science that, our bodies after being buried in the ground are consumed and reappear in the shape of the fragrant flowers that bloom over our resting places. Even this consolation, if so it may be termed, is denied us in the modern burying ground, for the mind cannot but revolt at the thought of sleeping beneath rank weeds or moldering in the damp heavy shade, away from the clear bright sunshine. The practice of making mounds over graves is one which should long since have been abolished. They doubtless served in the beginning as marks of locality, but now they simply disorder the ground. We could rest as calmly under the turf of a smooth level lawn as under a surface of ridges and hollows, while the proper keeping of a flat graveyard would be easy compared with that of an uneven one.

Niggardliness of space within the limits of a city may be a matter of necessity, but in the country, thus prescribing limits as to render the making of a few walks or the planting of a few ornamental trees an impossibility is without reason. In churchyards already in existence, this defect may not well be remedied; but where new ones are constantly being laid out, it is a question worthy of consideration whether a sufficiency of space should not at once be obtained so as to admit of some pleasing effect being produced by the exercise of taste in its arrangement, instead of making calculations with a view of utilizing to the utmost, for burial purposes, every available inch of ground. In monuments and gravestones, we hardly hope to see any change. Save the magnificent memorials which mark the graves of the wealthy, there has been but little alteration in their general style during the past century. The matter of designing inexpensive yet beautiful headstones is worthy of the attention of our architects, if only to relieve us from the grotesque or painfully plain pieces of sculpture which emanate from the workshop of the rural stone cutter.

In laying out a piece of ground for a burial lot, paths should be at first formed, and then the planting of suitable trees should follow. Among the latter, the weeping varieties, from the habit of growth they display, consort best with the character of the place. Flowering trees, especially, should be set out. Soft colors or whites should be selected, but not yellow, as the laburnum, as that would be inappropriate. For foliage trees, the beech, horse chestnut, weeping ash, birch, elm and others of graceful outline should be preferred, while a very few pines or dark toned shade trees may be interspersed for the sake of contrast. Evergreens of low growth, such as the *arbor vitae*, together with flowering shrubs, hollies, may bloom, syringas, lilacs or elders would form a pleasing variety, and at the same time furnish the bare sward without adding dullness or density. Creeping vines, twined around monuments, make even the plainest of stones an object of beauty. The trumpet creeper, sweet honeysuckle, woodbine, climbing roses, German ivy, and especially the hardy English ivy, are all graceful and appropriate. If we dispense with mounds, the places of interment might be covered with flower beds, of the shapes of the graves might be marked out on the green turf with flowery plants. Nothing could be prettier than a margin of snowdrops or lilies of the valley, inside of which might be a small cross of white crocuses. In spring time, exquisite designs may be worked out in purple and white hyacinths. The more delicate tinted flowers should be selected or else those of deep toned hue, neither brilliant nor gaudy. Pure white lilies, callas, purple violets, drooping white and pink fuchsias, cape jessamine, moss roses or white pinks, with candytuft for borders, can be arranged with exquisite effect.

These are all Nature's ornaments, and they were given us to brighten those spots which to the mind carry the most sombre reflections. "God's Acre" should be pleasant and cheerful, and not a place to be avoided as only suggestive of gloom and death.

INFLUENCE OF VARIOUSLY COLORED LIGHT ON ANIMAL AND VEGETABLE GROWTH.

This subject is at present attracting a good deal of attention, and strange to say it is regarded by many as a new matter for investigation, a patent even having been recently granted for the use of blue glass in the cultivation of plants. Several years ago, a committee of the British Association for the Advancement of Science investigated the whole question very thoroughly, and at various times individual observers have devoted their attention to the subject. The general result seems to be that growing plants thrive best in white light, while seeds, during the process of germination, do best under blue rays. The well known seedman, Charles Lawson, of Edinburgh, thus details the results of some experiments made by him in 1853: "I had a case made, the sides of which were formed of glass, colored blue or indigo, which case I attached to a small gas stove for engendering heat; in the case shelves were fixed inside, on which were placed small pots wherein the seeds to be tested were sown. The results were all that could be looked for; the seeds freely germinated in from two to five days only, instead of from eight to fourteen days as before. I have not carried our experiments beyond the germination of seeds, so that I cannot afford practical information as to the effect of other rays on the after culture of the plants.

I have, however, made some trials with the yellow ray in preventing the germination of seeds, which have been successful; and I have always found the violet ray prejudicial to the growth of plants after germination."

PLASTER CASTS.

If the ordinary plaster of Paris of commerce, which is sold in the form of a dry white powder, be mixed with water to the consistency of a moderately thin batter, the compound will in a short time become solid and firmly set. By this means, accurate impressions or casts may be taken of almost any object. The first step in making a cast is to prepare the mold, and in order to render this process clear, we will suppose that a simple object such as an apple or a plum is to be copied. A pint of plaster is placed in a bowl or similar vessel, the interior of which has previously been oiled. Water is then added until a paste is obtained. Now oil the fruit and press it down into the mixture until its part of greatest breadth is even with the surface of the liquid. An apple, for instance, should be inserted, calyx end down, and allowed to sink about half way—the middle of the fruit in most varieties being its largest portion. The plaster will soon set, when the object may be lifted out. With a sharp knife pare off all inequalities, fill up air bubbles with fresh plaster, smooth off the top of the mold perfectly level and make three or four countersinks in its surface—carefully oiling the latter, as well as the matrix left by the object. Replace the original in its socket, oil its upper portion and lay on plaster with a case knife, as fast as it will solidify. Continue to add material until the mold is brought to the proper form, nearly square and flat on top. When the plaster is perfectly hard, lift off the upper portion of the mold and remove the object; then oil the entire interior surface with linseed oil and allow it to dry.

The mold being completed, the cast is easily obtained. Fasten the two parts of the former together and bore a small hole of about three quarters of an inch in diameter in the side. Through this opening pour in the liquid plaster, which, after being allowed sufficient time to dry, will harden into the shape of the mold.

Those attempting the process for the first time should begin by making molds of simple objects until the necessary deftness of manipulation is obtained. Casts of heads, particularly of living subjects, should not be essayed until after considerable practice. A life size metallic bust may be used for the beginner's first efforts in figure molding; or, if he can obtain access to the dissecting room of any medical college, he may attain much greater skill by copying directly from the cadaver.

In making a mold of the head and face, the hair and whiskers should be mingled with potter's clay, brushed smoothly and oiled. The back of the head is taken first. This is done by pouring a quantity of the mixed plaster into a shallow tray and laying the head back into the mixture, allowing it to remain there until the plaster sets. It is then removed, the mold smoothed and oiled and countersinks made in its edge. Then oil the face and apply the plaster, a little at a time, being careful to see that it enters all wrinkles and indentations. In modelling from a living person, the breathing is done through the nostrils. When the material sets, lift the mold from the face and carefully smooth its interior surface. If the eyes are to be represented as open, carve depressions for the eyelids and also for the brows. Now fill up all indentations with overhanging edges which would catch the cast and prevent its extraction. Brush the interior of the mold over with linseed oil, let it dry, and fit the two sections accurately together. The casting liquid is poured in through the orifice left by the neck. Use but a little of the plaster at a time and roll the mold around so that the mixture will be evenly deposited in all its indentations. Finally fill the mold and set it aside to dry. When the sections are removed, the hardened cast may be finished with a sharp pen knife.

For delicate and accurate castings, the best method is that proposed some time since by Mr. Boyd Dawkins, F. R. S. The mold is made of artist's modeling wax, which, though soft and plastic when heated, becomes perfectly rigid when cold. The object to be copied is first covered with a thin powder of steatite or French chalk, to prevent its adhesion to the mold. The wax, which has been heated to a proper plasticity is then applied and carefully pressed into all the cavities of the original. When it is necessary, from the shape of the latter, to make the mold in two or more sections, steatite powder should be placed between to render them easily taken apart. The object should be removed from the mold before the latter becomes perfectly hard and rigid, as in that case it is very difficult to extract. After wetting the interior of the molds, to prevent bubbles of air lurking in the small interstices, pour in plaster of Paris. The casts, when dry, may be painted in water colors, which must be fainter than those of the original, because the next process adds to their intensity. After drying the cast, steep it in hard paraffin. The ordinary paraffin candles, which can be obtained from any grocer, will serve the purpose. Finally cool and polish the cast by hand, with steatite. By this process, casts of fossils or other objects in natural history may be made with such accuracy that it is with difficulty that they can be distinguished from the originals

The Corundum Region of North Carolina.

Professor Shepard, of Amherst College, Mass., in an article in the *American Journal of Arts and Sciences*, says that corundum has been recognized for above thirty years at several of the gold washings in the mountainous counties of North Carolina and Georgia, though rarely occurring in masses larger than would be called a coarse gravel. Within the last two or three years, however, under the stimulus of discovering an improved description of emery, many new localities of corundum have been brought to light.

The corundum localities are already known to occupy a stretch of country at least 170 miles long, with a breadth of about ten miles. As the region is little inhabited and very mountainous, it is probable that the corundum zone, as it has been called, will hereafter be much extended. It is situated in a subalpine country, partly within the northeastern corner of Georgia, and extending thence, in the direction of the crest of the Blue Ridge, into several contiguous counties of North Carolina.

The principal exposure of the corundum has been effected at what is known as the Culsagee mine, situated in the township of Elegée (sometimes written Elijay) situate eight miles southeast from Franklin Court House, in Macon county. This is the center of operations of the American Corundum Company, whose works are superintended by Colonel C. W. Jenks. The chief excavations have been made on the northern slope of a mountain, at an elevation of about 2,700 feet above tide water.

To Detect Sulphuric Acid in Vinegar.

An ounce of the vinegar to be examined is put into a small porcelain capsule, over a water bath, and evaporated to about half a drachm, or to the consistence of a thin extract; when cool, half a fluid ounce of stronger alcohol is to be added and thoroughly triturated. The free sulphuric acid, if present, will be taken up by the alcohol to the exclusion of any sulphates. Allow the alcoholic solution to stand several hours and filter; to the filtrate add one fluid ounce of distilled water, and evaporate the alcohol off by gentle heat over a sand bath; when free from alcohol, it is set aside for several hours and then again filtered. To the filtrate, acidulated with hydrochloric acid, add a few drops of a solution of chloride of barium, and a white precipitate of sulphate of barium will result, if the sample of vinegar has been adulterated with sulphuric acid.—*American Journal of Pharmacy.*

We wish that some of our readers would suggest a more easy method of detecting the sulphuric cheat in vinegar.—EDS.

SCIENTIFIC GARROTERS.—Dr. F. Kirkpatrick, Vice President of the Royal College of Surgeons, Ireland, while proceeding to visit a patient at ten o'clock at night, recently, was garroted in one of the most fashionable streets of Dublin, and deprived of his watch and chain. One of a gang of three men quickly rendered Dr. Kirkpatrick insensible by pressing firmly on the carotid arteries on both sides.

[Special Correspondence of the Scientific American.]

LETTER FROM PROFESSOR R. H. THURSTON.

CINCINNATI, Ohio., July, 1872.

A peculiar ferry boat at St. Louis. Visit to the wonderful iron deposits. How the ore is mined and transported. Progress of the great bridge at St. Louis. Engines and machinery of the Mississippi steamboats.

The railroad between Cincinnati and St. Louis takes the traveler through a pleasant level and partly wooded country, which, however, presents so little variety in its scenery that it becomes monotonous long before the end of the route is reached. The terminus is in East St. Louis, and the passengers are taken across the river by an oddly designed ferry boat, having a double hull with the single wheel placed between the two parts. The craft is about as broad as it is long, and it is quite remarkable that it should allow of such skillful manœuvering. The city of St. Louis is more of a commercial than a manufacturing city, and its levee is lined, nearly the whole length of the city front, with steamers which run to all the principal points upon the Mississippi and its tributaries. There is, however, in a city so large, and situated, as is St. Louis, at a point from which an extensive market can be readily reached, necessarily a considerable amount of manufacturing; and the proximity of those wonderful deposits of iron ore at

IRON MOUNTAIN, SHEPHERD MOUNTAIN, AND PILOT KNOB

has given rise to quite extensive iron works. The Laclede Iron Works at the north end of the city are quite large rolling mills and turn out excellent iron. The pig iron used is made from Iron Mountain ore. At Carondelet are to be found quite large and well managed blast furnaces which are supplied with ore from the Iron Mountain.

Having heard Pittsburgh manufacturers speak of this ore as fully equal, if not superior, to any ore found in the country, and having so frequently heard of its wonderful extent and remarkable location, a day was taken to visit the ore mountain. It is situated 85 miles from St. Louis, and a line of railroad leads directly past it. The ores mined at Iron Mountain and at the other almost equally noticeable deposits of Shepherd Mountain and Pilot Knob are thus readily brought to St. Louis, and are thence distributed, by rail and river, to all parts of the country west of the Alleghanies and south of the Lake Superior mines. The deposit is well named. It is a hill rising high above the general level of the country, and composed nearly entirely of an ore of iron that is almost absolutely pure. It is pure enough to make excellent Bessemer metal, a test which very few ores can successfully pass. This great hill, for it is hardly high enough to be called a mountain, contains millions of tuns of ore that can be obtained by simple quarrying and without the expenditure of a dollar for drainage or hoisting. The miners have attacked it at three points, and have been, for some time past, getting out and shipping about 1,500 tuns a day. As may be readily imagined, they have made immense cavities in the great mass of ore, and yet they are insignificant when compared with what remains untouched. The process of mining here is the simplest possible. After "stripping" off a few feet of earth, a mixture of ore and disintegrated rock is reached from which is obtained a large quantity of ore, in masses of some considerable size occasionally, but usually finely divided. This, Mr. Aubuchon, the superintendent, informs me is of as fine quality as the "bluff ore," and is preferred by some iron makers. After working through this deposit, which is usually of no great thickness, the hard solid "mountain" of ore is reached. Here the hammer, drill, and gunpowder are necessary, and the whole work is done by blasting. The scene presented here is strangely attractive and interesting. Six hundred men are employed at the mine, and they cluster among the loosened rocks and upon the unloosened crags like so many bees. The air is filled with the ringing sound of scores of hammers striking upon dozens of steel drills. Occasionally, in one or another of the three chasms, the sound of hammering suddenly ceases, and, while a minute curl of smoke commences to rise from the fuse in some hole which has just been charged, the whole body of miners employed in the cut scatters in all directions to find a safe retreat in which they cannot be reached by flying "spalls." A few moments pass, moments of suspense, usually, to the spectator unaccustomed to such work, and the sound of the explosion is heard. Sometimes it is a dull, smothered, almost unheard sound, and the sudden cracking and slight displacement of great masses of the mineral are the principal evidences that the tremendous forces brought into action have done useful work; at other times, a loud crash accompanies the report, and great pieces of ore fly in all directions, and then the miners emerge from their hiding places as suddenly as they disappeared, and go on with their work at hammer and drill or transporting the "won" ore to the railroad. Sometimes, but very rarely, some poor fellow is struck by a falling mass and severely injured or even killed; but such accidents are much less frequent than would naturally be imagined, and when they do occur are, almost invariably, the result of gross carelessness on the part of the sufferer. At the Iron Mountain such occurrences are almost unknown.

The ore, having been blasted out and broken up into pieces of proper size, is loaded into small cars or "buggies," as they are called, and these are pushed out of the cut and let down the mountain side on a track which guides them to the loading docks where they are dumped, the ore falling into the waiting cars on the siding; and the latter, when full, are made up into trains and drawn away by locomotives. Were the "buggies" allowed to run down the inclined plane without control, it would, of course, be quite impossible to prevent their destruction at the bottom. A strong iron wire rope is therefore made fast to the loaded "buggy" and, passing around a drum which is controlled by a powerful brake, the other end is attached to an unloaded buggy at the foot of the incline, which is thus drawn up by the loaded one as the latter descends. A man stationed at the brake has their speed under perfect control. There is probably not another mine in the country which possesses so many advantages for mining and for getting its ore to market as the one just described, and probably none in the world combines such advantages with the additional one of producing such excellent ore. Shepherd Mountain and Pilot Knob, in the same range, one or two locations as yet unworked in the Lake Superior range of iron ores, and a deposit in Rhode Island may at some future time compete, pretty closely perhaps, in some points.

There are two small charcoal blast furnaces at the mine, making iron from this ore mixed with a small proportion of a "leaner" ore obtained from a point distant about thirty miles from Iron Mountain. The iron is of excellent quality.

THE ST. LOUIS BRIDGE.

Returning to St. Louis, we visited the office of the Illinois and St. Louis Bridge Company, and were kindly allowed to inspect the plans of the great bridge which has already been referred to more than once. It promises to be a splendid work, and its completion will entitle Captain Eads and his ingenious and able assistants to a place by the side of the most celebrated engineers of our own or earlier times. They have so successfully surmounted every obstacle that has yet presented itself that it cannot be doubted that those which certainly still lie before them will also be as readily conquered. The substructure is so nearly completed that nothing really difficult remains to be done. The approach upon the St. Louis side is very nearly finished, the piers and abutments are all well up, and the approach upon the Illinois shore has made some progress. The really serious work remaining to be done is upon the superstructure and in its erection rather than in its construction. The bridge, when completed, will be a splendid structure and one that will be of great value to the whole country as well as to the city of St. Louis.

THE MISSISSIPPI STEAMBOATS AND THEIR ENGINES.

We were much interested in the engines and machinery of the steamboats on the Mississippi, but have no space in which to describe their peculiarities in detail. There is evidently frequent application of the "rule of thumb" in construction, and, particularly on tow boats, some risks accepted in management. Steam is carried fully up to the point prescribed as a limit by our faulty navigation laws; and, under the circumstances, it can hardly be expected that the most conscientious attention on the part of the inspectors can entirely prevent accidents.

Some good work has been done, however, and among other noticeable facts is the introduction of the compound engine on one or two steamboats. Properly designed, well built, and intelligently managed, compound engines and surface condensers should work well with the high steam and the muddy water of Mississippi steamboat boilers.

R. T. H.

Estimating Distance by Sound.

To the Editor of the Scientific American:

In a communication published by you on page 84, from J. W. Nystrom, he gave a table of speeds at which sound travels at different temperatures. It should not be forgotten that it was discovered more than ten years ago that, for very loud sounds, the velocity of propagation depends on its strength; so that while Mr. Nystrom's table is correct enough for ordinary sounds, it is by no means correct for claps of thunder, which are among the strongest sounds with which we are acquainted, and which therefore are propagated with much greater velocity than ordinary noises. Your correspondent is therefore as far wrong as the parties in Philadelphia whom he writes to correct. It was the Rev. E. S. Earnshaw, of Sheffield, England, who first published, in the *London, Edinburgh, and Dublin Philosophical Magazine* (for June, July, and September, 1860,) a profound mathematical investigation of the laws of the propagation of sound, by which he proved that the accepted view of nearly 1,100 feet per second at 40° Fah. is only correct for sounds of moderate intensity, whatever be their rapidity of vibration or wave length. He proved that the numerical value of a certain function in the theoretical consideration becomes much larger, in case of a loud clap of thunder, than it is for ordinary sounds; and he then brought in practical evidence showing that the crash of a thunderclap, striking the earth at more than a mile distant, was heard almost at the instant that the flash of lightning was seen. And, probably, it is not an uncommon observation during a violent thunderstorm to hear the sound simultaneously with, or very shortly after, the flash of lightning; we are then accustomed to conclude that the lightning fell very near to us; but if we take the trouble to investigate afterwards into the circumstances, we shall sometimes find that we have to deal with an identical case, as adduced by Mr. Earnshaw, in which the lightning stroke could not be less than a mile distant; so that the assertion of some that the sound of thunder travels a mile a second, as mentioned on page 84, may be true, and not only so, but this velocity may even be surpassed.

These theoretical and experimental considerations of Mr. Earnshaw were also practically confirmed by observations made during Captain Parry's arctic expedition. During artillery practice, it was found by persons stationed at a considerable distance from the guns, that the report of the cannon was heard before the command to fire from the officer, which latter in this cold and dry climate could also be heard at very great distances. Recently, Mallet took the matter up and made a series of experiments on the velocity with which sound is propagated in rocks, by observing the times which elapsed before blastings, made at Holyhead, were heard at a distance. He found that the larger the charge of gunpowder, and therefore the louder the report, the more rapid was the transmission. For instance, with a charge of 2,000 pounds of gunpowder, the velocity was 967 feet in a second, while with a charge of 12,000 pounds, it was 1,210 feet in the same time.

In the air, the differences between the propagation of an ordinary and violent sound appear much more considerable than in rock. But the fact that thus far we have no numerical measure for the comparative intensity or loudness of different sounds makes it impossible to find a numerical estimate for the velocity at these different degrees of loudness. This part of the investigation, therefore, will have to be postponed till we have found a real measure for the intensity of sound in place of the mere impression on our ears. In the meantime, let us be satisfied to know so much as that there is, and must be, a difference in the velocity of propagation; this makes it probable that, near the gun with which we experiment, this velocity is somewhat greater, diminishing as the distance becomes longer or shorter in proportion to the greater or less loudness of the explosion.

I will close by expressing the hope that some experimenters may take up this subject again, in order to verify or annul the last suggestion. I regret to notice that the writers of nearly all of our text books on physics content themselves with copying one another, so that it takes twenty years or more for an important discovery to become incorporated in their publications. I refer here not only to this special subject but to scores of others. I ought, however, to add that Professor B. Silliman, of New Haven, is in this respect an honorable exception. See, for instance, the last edition of his "Physics." P. H. VANDER WEYDE.

New York city.

MISCELLANEOUS ITEMS.

The *Commercial Bulletin* says: "The question of paying workmen on Monday instead of on Saturday, has attracted considerable attention at the West of late, and some of the manufacturers of Pittsburgh and elsewhere have adopted the plan. That such would be a reformatory measure, all thinking persons will at once acknowledge. With the present custom a workman is too often enticed into dissipation on the Saturday night because he has not to work on the following day, and he has also the financial ability to cater to his immoral and low tastes. This habit thus contracted is the worst enemy to the working man's prosperity and happiness that he has to encounter. In one night and the following day the hard toiling mechanic, who has labored faithfully and intelligently for six days, to earn a few dollars, dissipates away what really represents a portion of his life. Week after week he dives into the filth of dissipation, and each time his constitution and worth as a mechanic are impaired. If he did not receive his earnings on Saturday evening he would not have them to spend on Sunday, and the day would be to him what it was designed to be—a day of rest. It is true there are obstacles in the way of this reform, but none that really prevent it from being placed in execution in our manufacturing towns and cities, and we shall therefore look to see it yet in force in many of them."

The Winchester Arms Company, of New Haven, Conn., recently shipped their first instalment of 90,000 rifles to the Turkish government. Mr. Winchester is now in Europe arranging for another large contract.

The great building for the industrial exposition to be held in Louisville, Ky., commencing September 3, is finished, and pronounced sufficiently substantial for all the demands that may be made upon it. It covers a ground area of nearly two acres.

A portion of the nickel used at the United States Mint, Philadelphia, comes from Mine-la-motte, Mo. An exploration of the Missouri mines show a deposit five feet deep of a mixture of nickel and copper. It is estimated to be worth $600 per ton. Preparations are being made to ship these ores to England.

In South St. Louis, Mo., blast furnaces are soon to be erected. With the great expenditure of money and all the most modern appliances, it is expected these furnaces will be equal to any in the world. The yield from each furnace will be about seven hundred tuns per week of the best foundery iron.

The firm of W. H. Beach & Co., at South Bend, Indiana, will soon erect one of the largest paper mills in the country. It will occupy three acres of ground and cost $450,000.

George Washington Hinckley, of San Francisco, has recently obtained a patent for an ingenious oscillating combination of levers for the purpose of effecting, upon the stages of theaters, the rising, sinking, rolling and pitching motions of vessels at sea. So perfect is the imitation that, in connection with the sheet iron thunder, saltpeter lightning, and bellows wind, it makes the actors and actresses sea sick in a short time, and thus spoils the progress of the play. This, however, is not a serious objection, provided the sea sick scene be introduced for the finale.

ERRATUM.—In our illustration Fig. 3, on page 86, current volume, of the rotary pressure blower, the bases of the air chamber, D, should be represented of thickness sufficient to cover the apertures, C, while passing those points, thereby preventing escape of air from the chamber.

Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.

1.—Iron Rust Stains.—Will some one inform me of the best article for removing iron rust from white cotton and linen goods, and give directions for use?—R.

2.—Flying Machines.—Has there ever been a successful flying machine invented? Has any book on aerial navigation ever been published? Has any reward for an aerial ship, to fulfil certain conditions, ever been offered?—J. G.

3.—Root Beer.—Can ordinary herb beer be made to run through a soda draft apparatus, from under a counter or from a cellar without the aid of compressed air, pump, or any such device? Can any chemicals be put in to create a pressure, and what are they?—G. W. E.

4.—Milling Coins.—Will some of your correspondents please inform me through your valuable paper how half and quarter dollars are held while their edges are milled?—C. A.

5.—Spectroscope and Microscope.—Can any of your readers give me plain directions for constructing a spectroscope, giving size of prism, and of the telescope required to use therewith in observing ordinary phenomena, spectra of chemicals, etc. I should like, also, directions for constructing a compound microscope of power great enough to detect the *animalculæ* in water.—J. W. W.

6.—The River St. Lawrence.—Can any one inform me if the St. Lawrence discharges more water into the sea than the Mississippi or any other river on the North American continent?—J. O. A.

7.—White Vinegar.—Can you tell me of a process for discoloring cider vinegar, to answer the purpose of pickling as the white wine vinegar does? Where can I obtain a reliable treatise on pickling and canning fruit?—L. C. M.

8.—Air Pump.—In making an air pump, are the glass and the plate it sits on ground together so as to be air tight, or is there leather on the plate under the glass? How can I make a single barrel into a double acting pump?—J. N.

9.—Spontaneous Ignition.—Can any one inform me of any chemicals which, when combined, will produce an instantaneous flame or light, sufficient to illuminate a dial about 10 or 12 inches diameter?—G. T. R.

10.—Linseed Oil for Waterproofing.—Can any one tell me how to prepare linseed oil so that, when put on muslin, it will make it waterproof and will not crack when bent? I intend to use the muslin in the construction of a boat, and would like to have it black. I wish to make the boat air tight.—B. B. B.

11.—Position of Eccentric on Crank Shaft.—I have had an argument with my foreman about the position of the eccentric on the crank shaft of a steam engine. He holds that the eccentric should, in all slide valve engines, be placed at right angles to the crank, while I hold that it should be in that position only with a valve without either lead or lap, and should be removed from that position according to the amount of lap and lead upon the valve. Will some one decide the case?—M.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

Gilt Dip and Black Dip.—T. H., of Conn., sends an answer which is an advertisement. See notice at the head of this column.

Waterproofing Cotton Cloth.—A. B. C. should make a dough by dissolving 1 pound india rubber in 1½ pounds coal naphtha, and spread this on the cloth as thinly and evenly as possible. Five coats should be put on, and the cloth doubled together with the rubber coating inside, when it will be found to be airproof and waterproof.

Grinding Lenses.—If E. J. D. will go to a good optician and work with him a year or two, he will learn that turning and polishing the glass is only the alpha of knowing how to make a high power lens.—C. M., of Mass.

Red Ants.—To J. C. W., page 90.—Mix a teaspoonful of crystals of carbolic acid with an ounce of lavender water or any perfume and sprinkle well on your shelves, and the ants will undoubtedly skedaddle. An occasional sprinkle will keep you free from the pests. The perfume is not necessary, but is used to cover the unpleasant smell of the acid.—E. H. H., of Mass.

Hardening Soap.—To D. D., page 73.—Add hyposulphite of soda while the soap is hot. Twenty-four parts of this salt added to 112 of a softish soap will make a firm article on the addition of thirty parts or even more of water.—E. H. H., of Mass.

Removing the Crust of Shells.—To R. I., page 73.—You may remove the outside crust of shells, by immersing in dilute muriatic acid until the layers are dissolved off. Protect the inside if you wish by brushing over with a little wax and turpentine.—E. H. H., of Mass.

Permanent Marks in Electro-Chemical Telegraphy.—To G. B. M., page 73.—I would suggest brushing, over the prepared paper, a little thin starch, or passing the paper through the solution of starch, gum, or dextrin; or even wheaten flour might answer. Either would act as a protecting coat from the action of ozone, and would probably be no detriment in practical working, but possibly an advantage.—E. H. H., of Mass.

Strength of Citric Acid.—To T. W. S., page 90.—Average lemon juice contains six to seven per cent of citric acid. Lemons vary in size; find out the quantity of juice and calculate.—E. H. H., of Mass.

Fly Paper.—To T. W. S., page 90.—Equal parts of molasses and Venice turpentine melted together and spread on paper.—E. H. H., of Mass.

Patent Leather.—To S. B. D., page 90.—This is produced by a double operation. First, several coats of linseed oil and ochre, etc., are applied so as to fill up the pores of the leather, and the surface is rubbed smooth. Four or five coats of a mixture of boiled oil and copal varnish are put on very thin, rubbed smooth, and dried at a moderately high temperature. In this way the fine gloss is obtained and the surface will not be liable to crack. Care and experience in this, as in all manufactures, are required to produce a perfect article.—E. H. H., of Mass.

Wire for Sieves.—To A. C. S., page 90.—Use No. 16 or larger copper wire, and you will find your sieves tolerably durable.—E. H. H., of Mass.

Aniline Inks.—To C. I., page 90.—Generally you will find them to fade on exposure to light, especially to the direct rays of the sun.—E. H. H., of Mass.

Anatomical Specimens.—T. G. H. I., page 90.—These are both dried and preserved in various menstrua. Some are injected in various ways, so as to show distinctly the arteries, veins, capillaries, etc. Imitations are made in leather, wax, etc.—E. H. H., of Mass.

Compressibility of Water.—To L. E., page 90.—Practically, water is not compressible, and this peculiar property renders it of great service where an elastic or compressible medium would be useless.—E. H. H., of Mass.

Impure Water.—To I. W. L., page 90.—Put into your pitchers a lump or two of fresh charcoal, and allow it to remain a while, or, better, filter the water through a good charcoal filter. There is a filter called the silicated carbon filter that I know to be a first class instrument for this purpose. It probably can be got in any large city.—E. H. H., of Mass.

Drying Fruit.—To E. E. S., page 90.—Make a frame building with glass top, like a hot bed frame for raising early plants. Have the whole inside painted black and arranged with shelves on which to place your fruit. The sides and bottom being made thick, of brick, etc., will retain the heat absorbed during the day from the sun's rays, and gradually give it off when he is out of sight. Near the bottom there should be a few holes to admit air, and at the top a few to let off the moisture laden atmosphere; that is, a current will result, and can be regulated by stopping up as required. I know two such frames used most successfully in this neighborhood for drying a wet paste, and have no doubt it will do for fruit. Take the flue pipe of your stove round such a building, and so utilize what now is so much waste heat.—E. H. H., of Mass.

Fetid Water.—To F. D. H., page 90.—You do not say of what material your cistern is made, nor where the water comes from, what sort of paint about it, etc. Are the pipes from the pumps of iron? Give more particulars, and I will try to help you.—E. H. H., of Mass.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

Piston Packing.—Crawford Tibbets and Daniel L. Weaver, of Riverton, Ky.—This invention relates to new and useful improvements in packing the pistons of steam engines, and consists in a hollow piston, which is formed of a body and ends, between which is placed a perforated flanged ring. Outside this ring are placed metallic packing rings which are furnished with steel spring rings. Each end of the piston is provided with a passage and valve opening inward. The steam which enters one of the passages opens the corresponding valve and is discharged into the interior of the piston, from which it passes through the flanged ring and expands the steel and packing rings. This interior pressure also closes the valve in the opposite end of the piston. This occurs while the piston is traveling in one direction. At the end of the cylinder it changes its direction, and the action of the valves is reversed. When the steam is shut off from the cylinder the pressure inside the piston closes both the valves and keeps the packing rings set out to the cylinder.

Washing Machine.—Moses Walker, of Keeseville, N. Y.—This invention relates to a new and useful improvement in machines for washing clothes, and consists in an endless revolving washing board which is formed by connecting fluted wooden slats with canvas and other straps, and is supported on a driving shaft or roller within a box. A piece of fluted rubber is arranged above the washboard in such a manner that a vibratory motion is imparted to it by revolving the driving shaft. The clothes are placed between the board and the rubber. By means of the endless washboard it will be seen that any particular portion of the clothes may be retained on the board and rubbed as long as desired.

Culinary Pot.—John S. Kidd, and Mrs. Mary Melville, of Brooklyn, N. Y.—This invention consists of a cluster of two or more independent boiling pots, adapted for use, singly or together, in one ordinary pot hole of a stove. The form of the sectional pots varies somewhat according to the number of sections in a cluster, but it is always such as to form a suitable figure with the projecting bottoms where they enter the stove hole. The stove cover is made with a corresponding cluster of holes, and a cover for each, so that when all the pots are not used the unused holes can be covered. To use the improved pot on stoves with the ordinary round pot holes, a cover with appropriate holes in it may be employed, but this is not essential when all the pots are used. These pots are very useful with parlor cook stoves having only one hole: also on ordinary cook stoves in summer, when it is preferred to have a small fire concentrated under one hole only.

Railroad Switch.—John Shafer, of Tunnel Hill, Pa.—This improvement in switches consists of a novel arrangement whereby the rails for the main line maintain their complete form, and do not have the tongue or frog common to ordinary switches. One part of the switch consists of a widened and elevated piece on the outside of one of the main rails, which is so formed that, in connection with an opposite guard rail, the wheels are thereby forced over from the branch line on to the main line. A siding is used to adjust the opposing rail ends. In running from the main track on to the branch the proper adjustment, of the siding alone, effects the object.

WASHING MACHINE.—Francis M. Ellis, of Galva, Illinois.—This invention improves the construction of the washing machine for which letters patent were granted to the present inventor June 13, 1871, and makes it more convenient in use and effective in operation.

POCKET FLASK.—Rogers George, of New York city.—This invention furnishes an improved pocket flask which is simple in construction and convenient in use; it is so constructed that the cup may be secured to the flask by the same cork or stopper that closes the flask.

PLOW.—Lewis B. White, of Norfolk, Va.—This invention relates to a new plow, which is provided with an adjustable share, mold board, beam, and weeding attachment, in order to render it adjustable to all kinds of soil and manners of preparing the same. It consists, first, in providing the share and mold board with backwardly projecting slotted ears, whereby they are secured to the standard, and, owing to the slots, are made adjustable thereon. The invention also consists in providing the mold board with detachable extension pieces or wings; also in the use of reversible up and down adjustable weeders, applied to a longitudinally adjustable stock or holder; and finally, in making the beam adjustable on the standard and handle so as to regulate the width of furrow and the inclination of the plow share.

PADDLE.—Calvin C. Everson, of Palmyra, N. Y.—This invention furnishes an improved paddle or oar for propelling boats, which is so constructed as to encounter great resistance from the water when moving in the direction to propel the boat and very little resistance when moving back for another stroke; it consists in making the blade of the oar of two swinging paddles, set in a frame. When pulling the paddles rest on the frame and resist the water. When the motion is reversed, the paddles are thrown outward and the water passes through the frame.

SILVERWARE BOX.—Edmund Steinle, of New York city.—This invention consists in making the bottom of a silverware or other show box adjustable and supporting it upon the cover, which is made to correspond in size and to be detachable for that purpose. The cover is not hinged to the sides, but is constructed so that it fits inside of them. The bed or bottom for the support of the ware is not attached to the sides, but is fitted so that it can rise up to their top, or nearly so, and it is connected with the side by straps to prevent it rising too high. By this construction the cover can be taken entirely off so that it will not be in the way and obstruct the view of other pieces in the show case.

POLISHING POWDER.—Thomas R. Hubbard, of Brooklyn, N. Y.—This invention has for its object to utilize the deposits of topaz found in the United States. Being found in a comparatively pure state and of great hardness, it is admirably adapted to the abrading and polishing of metals and other mineral and other substances, and its heat-resisting qualities make it useful in fireproof structures of every kind. The invention consists in reducing the topaz to a powder more or less fine, and in incorporating it with alumina and silex or clay as cementing materials.

STAIR ROD.—Edward Schlichting, of New York city.—This invention relates to a new manner of constructing stair rods by making them extensible, so as to fit them to carpets of suitable width; and it consists in constructing them in sections which are made to slide one within another telescopically.

DADO PLANE.—Rufus H. Dorn, of Port Henry, N. Y.—This invention produces a grooving plane which can be adjusted, without change of knives, to cut narrower or wider grooves; and it consists in the application, to the plane, of a pivoted cutting blade which can be swung more or less to one side to enlarge the scope of its action. It also consists in several other details of improvement, and in the combination with the swinging blade of a laterally adjustable spur or marking blade, which is set in accordance with the position of the swinging blade.

TILE.—George A. Davidson, of Malden, assignor to himself and Horace T. Caswell, of Troy, N. Y.—This invention consists in beveling the edges of stone tiles by the saw, so that they can be laid as they come from the sawing machine without any additional labor whatever.

SEWING MACHINE FOR BOOTS AND SHOES.—Nathan M. Rosinsky, of New York city.—This invention relates to improvements in machines for sewing the uppers of boots and shoes to the soles; and it consists in certain arrangements of a loop holder with the needle or awl, and in the apparatus for operating it; also, in a novel construction of the feed apparatus. It is more especially designed to perfect the machine patented by the present inventor May 16, 1871.

MOSQUITO NET FRAME.—Seymour Hughes, of Jersey City, N. J.—This invention relates to a novel apparatus for suspending mosquito nets over bedsteads and for contracting and expanding the same whenever desired. It consists principally in the arrangement of a rectangular frame about as large as the bedstead, and in the application to it of a sliding cross bar, to which the side of the top of the mosquito net is secured. The remaining three sides of the top of the net are fastened to the rectangular frame and can slide on the sides of the same. The frame is suspended from the ceiling in such manner as to vibrate easily to protect the net, in case it is stepped upon, and prevent it from being torn.

COMBINATION LOCK.—James Pigot, of Brooklyn, N. Y.—This invention furnishes an improved combination lock, in which any combination of four letters can be used to guide the operator in actuating the lock, and as many different combinations of four may be had as twenty-six are capable of.

ELECTROMAGNETIC MOTOR.—José S. Camacho, of Habana, Island of Cuba.—This invention relates to a new electromotor, which is applicable to the propulsion of vehicles, such as railroad cars, small or large vessels, and to the operation of machinery, and other useful purposes. It consists principally in such a combination of a wheel, containing a series of electromagnets that have an unvarying direction of electric current, with a series of stationary electromagnets, in which the direction of the current is reversed at regular intervals, that, by the changed polarity of the stationary electromagnets, their respective power of attraction is so changed or rather transmitted from one to the other that the wheel magnets are caused to follow such transmission, whereby the wheel is turned. The invention also consists in a new current-regulating mechanism; and also in a novel construction of electromagnets for the purpose of obtaining a larger ratio of power from a given length of coil than could be derived by the plain cores of ordinary electromagnets.

WASHING MACHINE.—Jonathan Hunsberger, of Shippack, Pa.—This invention is an improvement on those washing machines using a fixed and a swinging board, and consists in so arranging the mechanism which operates the movable one that the ribs of one board are made to enter the spaces between the ribs of the other.

FRUIT BOX.—William Nicklin, of Marlborough, N. Y.—This invention furnishes, as an article of manufacture, a berry box made of pasteboard by riveting together the hoop, bottom, and cleats.

FISH HOOK.—Edward Pitcher, of Brooklyn, N. Y.—This invention furnishes an improved fish hook, which is so constructed as to prevent the fish getting off the hook and being lost; it consists in so arranging a double wire spear with the line and hook that, upon the fish taking the latter, the spear is pulled down and pierces him.

DRAWING FRAME.—Samuel Brooks and John Standish, of West Gorton, England.—This invention furnishes an improvement in machinery for preparing cotton and other fibrous substances, and consists principally in a construction and arrangement of the devices which constitute the stop motion of drawing frames, by which their operation is made more perfect than heretofore.

SASH HOLDER.—Daniel J. La Due, of Carroll city, Iowa.—In this invention both side edges of each sash have corrugated or roughened strips of metal fitted into them. In one side of the frame is inserted a small metal box which contains a pivoted jaw and a spring. The spring connects with the lower part of the jaw, and tends to draw the roughened upper part of the same off the sash. A screw, having a pointed end and fitted through the side of the frame and box, enters with its point a hole in the jaw. When the screw is forced further in, so that the larger part of its conical point gradually passes through the jaw, the latter is thereby swung against the sash to lock it at whatever hight it may be desirable to hold it. When the screw is withdrawn, the spring withdraws the jaw from the sash, allowing the latter to be raised or lowered at will.

CRANE.—Gasper Hunziker, of Summit, Miss.—This improvement consists in pivoting a horizontal crane arm to a vertical shaft below its plane by crossed arms, which extend below the pivot and terminate in a toothed segment, with which a crank shaft and pinion are connected. At each end of the horizontal arm is a grooved roller, and the hoisting rope hangs from one end for engaging the weight and passes over the other end down to the drum. The loads are raised by the drum and cord, the crank shaft being locked fast. The loads are balanced on the upper part of the shaft, or nearly so, by the extension of the horizontal arm across the top of the shaft so that the side draft on the vertical shaft, common to ordinary cranes, is mostly obviated. The arm is shifted forward and backward by the segment pinion and crank shaft to adjust it to the work in hand, and the end from which the weight is suspended is thus raised or lowered, as circumstances may require.

BEEFSTEAK CHOPPER.—Elizabeth Atkins, of Monroe, Louisiana.—This invention consists of a pair of rollers or cylinders which are made with acute angular flutes and arranged horizontally in the same plane for rolling together, one being turned by a crank; they are provided with a clearer or discharger below for preventing the meat being carried around with the rollers. One of the rollers is adjustable toward and from the other, and is provided with an adjusting screw and a spring for allowing it to be self adjusting to some extent as the meat varies in thickness or resistance. The fluted portions overhang the housings, so that the bones in the meat are guided along the ends while the meat passes between them. The steak is presented to the rollers by suspending it by the hand above and between them.

WATER CLOSET SEAT.—Charles Ledwich, of Fishkill Landing, N. Y.—The object of this invention is to improve the mode now in common use of setting the bowls of water closets. The usual mode is to set the flange of the bowl in putty, which is liable to become loose and get displaced, and render instant repairs necessary. The difficulty of getting at the source of the trouble renders the services of the plumber expensive, while the gases thus liberated are a constant source of annoyance, as well as detrimental to health. In this invention all this trouble is avoided by applying a double rubber packing ring to the flange of the bowl so as to make a perfectly tight joint.

STRAINER PIPE.—Ames Harris, of Minneapolis, Minn.—This invention relates to a new manner of perforating pipes to be used in oil wells and other places, so that they will serve as strainers for water or other liquids. The invention consists in grooving the pipe longitudinally on one side, and in cutting a screw thread along its other side to such a depth that the spiral grooves are deeper than the material left under the longitudinal grooves. This causes a perforation to appear at every crossing of a spiral and longitudinal groove. A very fine and regular system of strainer is thus produced, which is cheap to produce, of great strength, and more convenient to handle than the tubular strainers now in use.

BARN DOOR HANGER.—William W. Soden, of Unadilla, N. Y.—This invention relates to an improvement in door and gate hangers, and consists of a grooved rail in combination with a beveled or oval faced roller; the side walls of the groove are cut or notched down to the bottom at suitable intervals along the rail, and, preferably, on the opposite sides alternately, to allow the water or other matters collecting in the groove to escape and not to obstruct the rollers. Grooved rails with oval or beveled head rollers are used in preference to the oval rails with grooved wheels, to save the expense of forming the grooves in the wheels, as the rails can be cast with the grooves without any cost for the groove beyond the cost of the simplest form of casting.

CLOTH CUTTING MACHINE.—Fredrich Koch and Robert Brass, of Williamsburg, N. Y.—This invention relates to a new machine for cutting cloth of suitable thickness by means of a reciprocating blade, which has its cutting edge parallel to its line of motion. It consists chiefly in the arrangement, around the reciprocating cutter, of a circular table which carries the feed mechanism, and which, when turned, causes also the rotation of the cutter in an equal degree, although it does not interfere with the up and down motion of the same. The invention also consists in the arrangement of a yoke shaped swivel arm, which holds the upper part of the mechanism, and which is swiveled so that it can be swung to either side out of the way of the cloth which is being fed. This is an important item, as it permits the cutting of large pieces on the machine and in suitable direction. It also comprises a new and peculiar manner of imparting motion to the double feed, and to a new combination of the concentric tubes that embrace the reciprocating cutter.

LOW WATER INDICATOR FOR STEAM BOILER.—Clement Brooks, Norfolk, Va.—The invention is an improvement in the class of low water indicators for steam boilers wherein a ball or weight is employed, and the object is to increase the reliability of the operation of the actuating devices without correspondingly increased complication or number of parts.

HYDRANT.—John W. Murphy, Baltimore, Md.—The invention consists in connecting with a water tight plunger a central water-conveying pipe and a valve so that the same movement which unseats the valve allows the water to pass directly up. 2dly. In placing, between an adjustable cap and its supporting cylinder, the packing that keeps the plunger watertight, whereby a turn now and then on the clamp screw will take up all wear for a long time. 3rdly. In placing the end perforated flange by which the hydrant is firmly held in its box diagonally across the bottom thereof, so as to prevent splitting said bottom.

PLOW.—Edward S. Cook, Laurel Grove, Va.—The invention consists in new modes of locking the landside, moldboard, and share to a skeleton frame so that they cannot be forced by any strain out of their desired relations to each other, in providing an intermediate brace by which the handles and mold board may mutually react and support each other against pressure; and finally in a peculiarly constructed skeleton frame which admits of a subsoiler being readily converted into a turnplow.

LOCOMOTIVE SMOKE STACK.—Keyran J. Duggan, of Montgomery, Ala.—In this invention the improved construction is calculated to economize the cost and to dispense with inside pipes, which greatly interfere with the removal of the stack for cleaning and repairs. It consists principally in joining the opposed cones of the stack by angle iron rings, by which is supported a cone formed of two plates of sufficient size to leave an annular passage for the smoke of about ten inches in width in large stacks. A wire gauze spark arrester is arranged at the top of the stack.

CAR COUPLING.—Nathan Swigart, of West Richfield, Ohio.—The object of this invention is to improve the apparatus for coupling cars together on railroads; it consists in a device, for rendering the cars self separating in case of accidents, which operates as follows: The coupling pin is provided with a lug pin, which stands at right angles with it, a short distance above the end of the link, and is so placed that if the other end of the link drops, or the car falls from a bridge, or by any means becomes so depressed below the level of the track as to lower one end of the link, the other end strikes the lug pin and the link acts as a lever to pry the coupling pin up, the mouth of the drawhead being the fulcrum. As soon as the lower end of the pin is raised from the lower part of the drawhead, it releases the link and the cars are separated.

GRAIN METER.—Archibald McBride, of Fayette, Pa.—This invention furnishes an improved grain meter which consists essentially of the following parts: A tilting hopper made in two parts and provided with a shifting weight; automatic opening and closing gates through which the hoppers are discharged; spouts or hoppers for holding bags; a shifting or moving bar for working a registering apparatus, and a regulator for controlling the movement of the weight.

HAND SEEDER.—Barton W. Harris, of Williamsport, Ohio.—This invention comprises a long light trough provided with a strap or cord by which it is suspended from the shoulders of the sower; the bottom of the trough is divided lengthwise into several short concave sections with a feed hole at the bottom of each which is covered by a curved oscillating gate with holes for the seed to fall through and with projections for pushing away any objects too large to pass through the holes in the bottom of the trough; the gates swing on pivots and have arms extending above the pivots to a reciprocating bar at the top of the trough, which is worked by a hand lever.

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6,003.—CARPET.—W. Mallinson, Halifax, England.
6,004.—CARPET.—A. McCallum, Halifax, England.
6,005.—FAN.—J. McLoughlin, Morrisania, N. Y.
6,006 and 6,007.—CARPETS.—J. Patchett, Halifax, England.
6,008 and 6,009.—CARPETS.—D. Paton, Halifax, England.
6,010.—CORNER PIECE.—A. Soper, Whitestown, N. Y.
6,011.—CARPET.—G. C. Wright, New York city.

TRADE MARKS REGISTERED.

921 and 922.—WRITING INKS.—Adams & Fay, Cleveland, O.
923.—AXES.—Biddle Hardware Co., Philadelphia, Pa.
924.—SOAP.—J. Buchan & Co., New York city.
925.—WHISKY.—M. Crichton, Baltimore, Md.
926.—LINIMENT.—W. Crow, New York city.
927.—CIGARS.—Gaullieur & André, Key West, Fla.
928 to 930.—PLUG CHEWING TOBACCO.—Harris, Beebe & Co., Quincy, Ill.
931.—MOLASSES.—A. Thomson & Co., New Orleans, La.
932.—BOOTS.—J. H. Walker, Worcester, Mass.

DISCLAIMERS.

20,959.—RAILWAY SWITCH.—M. Smith. Filed July 18, 1872.
20,927.—JOINT FOR CONDENSER.—H. Allen. Filed July 20, 2872.
20,649.—VAPOR LAMP.—A. M. Mace. Filed June 19, 1872.

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

21,986.—LOCOMOTIVE TRUCK.—Levi Bissell. Oct. 16, 1872.
21,962.—CAR SPRING.—P. G. Gardiner. Oct. 16, 1872.

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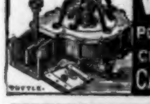

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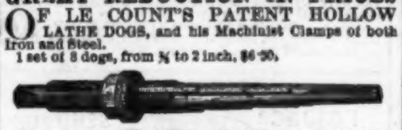

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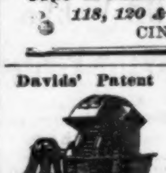

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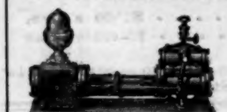

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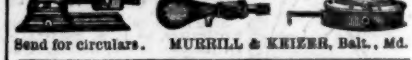

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